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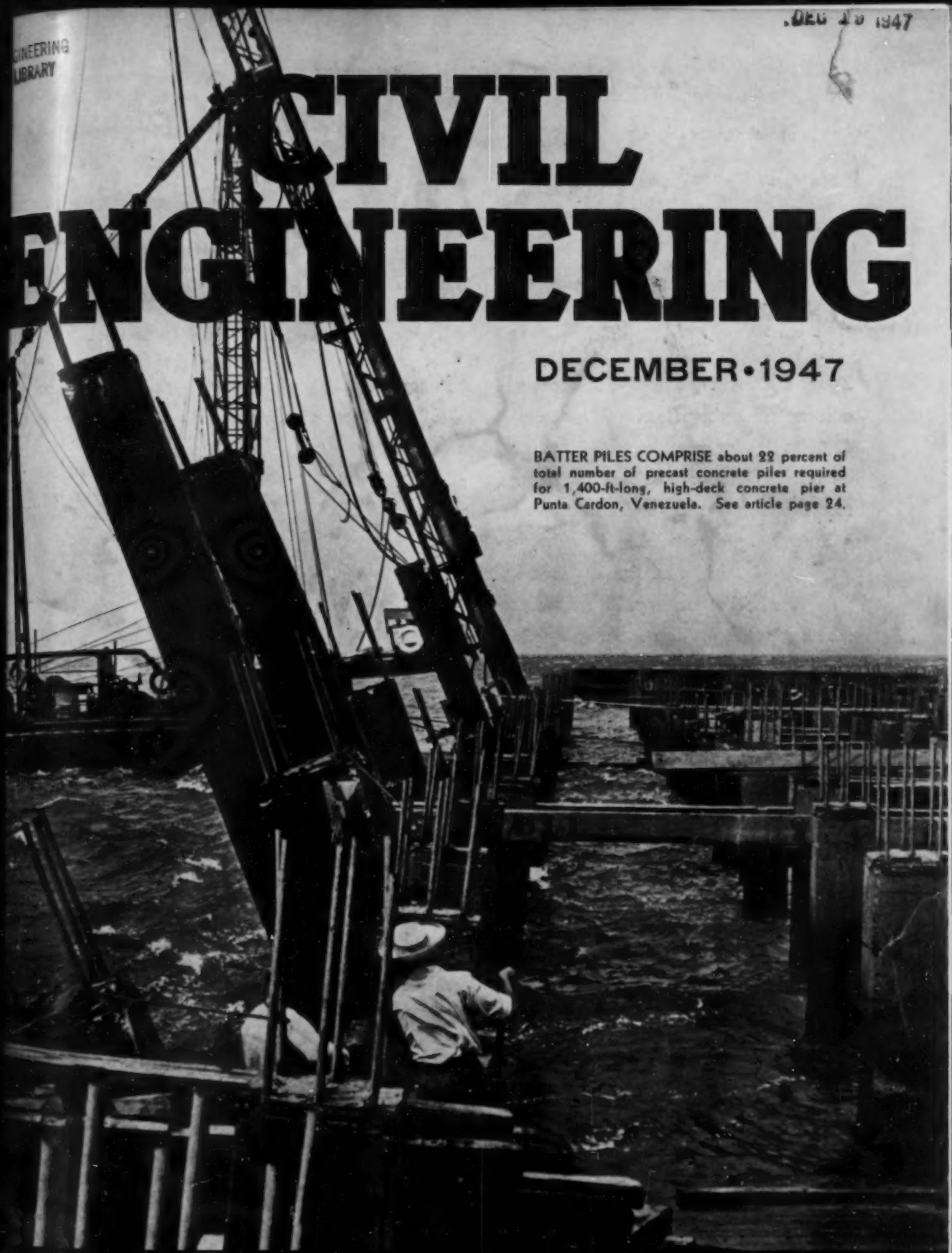

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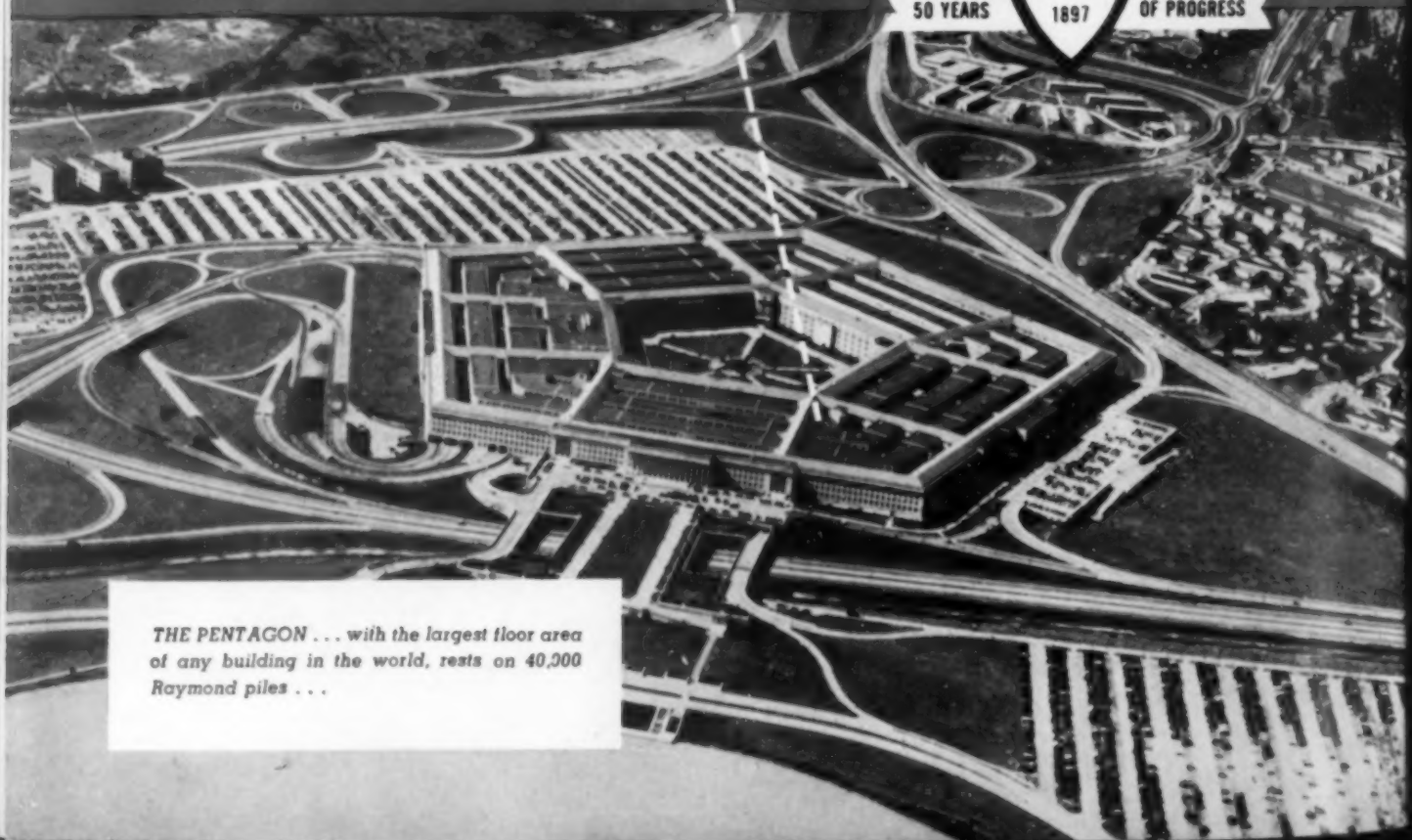

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DECEMBER 1947
Volume 17 Number 12

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• *In This Issue*

Program of Ninety-Fifth Annual Meeting 13
Virginia Launches Record Highway Reconstruction Program . . 18
Plans for United Nations Headquarters Stress Functional Design . 23
Expert Analyzes Problems of Heavy Construction Contractor in South America . . . . . *J. J. Collins* 24
Modernization of New York Highways Will Cost State Two Billion Dollars 29
Continuous-Flow, Self-Cleaning Diversion Works Increase Water Supply of Colorado Steel Plant . . . . . *Alfred J. Ryan and R. L. Parshall* 30
New Standard Covers Lightweight Floor Construction 36
Gantry Crane Expedites Erection of Rotary Kiln 36
Civil Engineers Share Knowledge of Fluid Mechanics with Many Related Professions . . . . . *Hunter Rouse* 37
Earthfill Dam Is Unit in Missouri Basin Project 39
Wind Tunnel Tests Determine Effect of Slots and Fins on Stability of Bridge Sections . . . . . *D. B. Steinman* 40
More Power for Puget Sound Area 43
Welded Steel, 40,000-Gallon "Golf Ball" Rests on 65-Ft "Tee" . . 44
Soil-Cement Tested as Low-Cost Canal Lining 45

• *Society News*

Voluntary Contributions 52
Board of Direction Elects Four Honorary Members 52
Biographies of ASCE Officers for 1948 53
Life Member's Check Opens Loyalty Fund 57
United Engineering Trustees Elects Officers 57
Compromise Between President and Congress Needed for National Science Foundation 58
James W. Rickey Medal for Papers in Hydroelectric Field 59
Society Member Wins John Fritz Medal 59
CIVIL ENGINEERING Index for 1947 Available on Request 59

• *Departments*

Engineers' Notebook 46
The Readers Write 48
News Briefs 65
N.G. Neare's Column 80
Meetings and Conferences 80
Wool Gatherings 80
New in Education 82
New Publications 84
News of Engineers 84
Deceased 93
Recent Books 98
Applications for Admission and Transfer 100
Men and Jobs Available 104
Changes in Membership Grades . . 108
Equipment, Materials and Methods 114
Literature Available 118
Index to Advertisers 124

Original Woodcut by Lynd Ward

Farther and farther extend the outposts of utility services in which cast iron pipe plays so important a part. Over 13,000 cities, towns and services are served by water supply systems—8500 have gas service.

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Ninety-Fifth Annual Meeting

Commodore Hotel, New York, N.Y., January 21–24, 1948

Business Meeting, Prize Awards, Conferring of Honorary Memberships

WEDNESDAY—JANUARY 21, 1948, MORNING

GRAND BALLROOM

9:00 Registration in Grand Ballroom Foyer

10:00 Ninety-Fifth Annual Meeting called to order by

EDGAR M. HASTINGS, President, American Society of Civil Engineers.

Report of Board of Direction

Report of Secretary

Report of Treasurer

10:30 Presentation of Medals and Prizes

The Norman Medal to BORIS A. BAKHMETEFF, Hon. M. ASCE, Professor of Civil Engineering, Columbia University, and WILLIAM ALLAN, M. ASCE, Dean of Civil Engineering, School of Technology, College of the City of New York, for Paper No. 2288, "The Mechanism of Energy Loss in Fluid Friction."

The J. James R. Croes Medal to THOMAS R. CAMP, M. ASCE, Consulting Engineer, Boston, Mass., for Paper No. 2285, "Sedimentation and the Design of Settling Tanks."

The Thomas Fitch Rowland Prize to R. F. BLANKS, M. ASCE, Materials and Testing Engineer, U.S. Bureau of Reclamation, Denver, Colo., and H. S. MEISSNER, M. ASCE, Civil Engineer, Materials Laboratory, U.S. Bureau of Reclamation, Denver, Colo., for Paper No. 2283, "Deterioration of Concrete Dams Due to Alkali-Aggregate Reaction."

The James Laurie Prize to ROSS M. RIEGEL, M. ASCE, Head Civil Engineer, Design Dept., Tennessee Valley Authority, Knoxville, Tenn., for Paper No. 2291A, "Structural Features of Hydraulic Structures."

The Collingwood Prize for Juniors to F. L. EHASZ, Assoc. M. ASCE, Structural Design Engineer, Sanderson and Porter, New York, N.Y., for Paper No. 2287, "Structural Skew Plates."

10:40 Presentation of Division Prizes

The Rudolph Hering Medal to A. L. GENTER, M. ASCE, Consulting Engineer, Baltimore, Md., for Paper No. 2280, "Computing Coagulant Requirements in Sludge Conditioning."

The J. C. Stevens Award to MAURICE L. ALBERTSON, Jun. ASCE, Associate Professor, Civil Engineering Department, Colorado Agricultural and Mechanical College, Fort Collins, Colo., for his discussion of Paper No. 2266, "Evaporation from a Free Water Surface."

The Karl Emil Hilgard Prize to A. A. KALINSKE, Assoc. M. ASCE, Engineer, Infilco Inc., Chicago, Ill., for Paper No. 2273, "Conversion of Kinetic to Potential Energy in Flow Expansions."

10:50 Conferring of Honorary Memberships

JOHN B. CHALLIES, Hon. M. ASCE, Vice-President, Shawinigan Water and Power Co., Ltd., Montreal, Quebec, Canada.

HARDY CROSS, Hon. M. ASCE, Professor of Civil Engineering, Yale University, New Haven, Conn.

WILLIAM H. MCALPINE, Hon. M. ASCE, Chief Engineer, Office of the Chief of Engineers, USA, Washington, D.C.

KARL TERZAGHI, Hon. M. ASCE, Consulting Engineer and Lecturer, Graduate School of Engineering, Harvard University, Cambridge, Mass.

11:30 New Business

Report of Tellers on Canvass of Ballot for Officers

Introduction of President-Elect and New Officers

12:00 Adjournment for Luncheon

Wednesday Luncheon—Grand Ballroom—12:30 p.m.

Committee: Arthur A. Collard, Chairman; Brother B. Austin Barry

At the close of the morning session there will be a luncheon for members, ladies and guests in the Grand Ballroom of the Hotel Commodore. Tickets: $3.50 for members, ladies and guests

Wednesday Afternoon—General Session

THE PROBLEM OF THE PANAMA CANAL

GRAND BALLROOM

2:30 An Improved Panama Canal

JAMES H. STRATTON, M. ASCE, Col., Corps of Engineers, D.A., Supervising Engineer, Special Engineering Division, The Panama Canal, Diablo Heights, C.Z.

3:00 Discussion

NOTE: Following this general session on the Problem of the Panama Canal, there will be sessions of the Construction Division, Hydraulics Division, Soil Mechanics and Foundations Division and Waterways Division on Thursday and Friday devoted to the Panama Canal studies in their particular fields.

Dinner and Dance on Wednesday

GRAND BALLROOM

Committee: L. H. Csanyi, Chairman, Nomer Gray and William S. LaLonde, Jr.

7:00 Assembly **7:45 Dinner** **10:00 Dancing**

Dinner will be served promptly at 7:45 p.m. Arrangements have been made for tables seating 10 persons and members may underwrite complete tables. Orders to underwrite a table must be accompanied by a check in full and a list of guests.

Tickets will be $8.00 each. Tickets for Juniors for the Dance only will be $2.00 per couple.

The seating list for the Dinner-Dance will close at 5:00 p.m., Tuesday, January 20.

Those who purchase tickets after that hour will be assigned to tables in order of purchase.

Tickets will be on sale at the Registration Desk until 5:00 p.m., Wednesday, January 21.

Sessions of Technical Divisions—Thursday Morning

Sanitary Engineering Division

GRAND BALLROOM

Dean Gordon M. Fair, Chairman, Executive Committee, Sanitary Engineering Division, Presiding

Symposium on Operations of Authorities Concerned with the Sanitation of Rivers and Harbors

10:00 Introductory Remarks

GORDON M. FAIR, M. ASCE.

10:10 Legal Aspects of Compact Legislation in New England

WARREN J. SCOTT, M. ASCE, Director, Bureau of Sanitary Engineering, Connecticut Department of Health, Hartford, Conn.

10:30 Classification of Streams under Consideration for Compacts in New England

ARTHUR D. WESTON, M. ASCE, Director and Chief Engineer, Massachusetts Department of Public Health, Boston, Mass.

10:50 Operations of the Interstate Sanitation Commission

SETH G. HESS, M. ASCE, Director and Chief Engineer, Interstate Sanitation Commission, New York, N.Y.

11:10 Operations of the Interstate Commission on the Delaware River Basin

JAMES H. ALLEN, M. ASCE, Executive Secretary, Interstate Commission on the Delaware River Basin, Philadelphia, Pa.

11:30 Operations of the TVA

ROBERT N. CLARK, M. ASCE, Chief Public Health Engineer, Tennessee Valley Authority, Chattanooga, Tenn.

11:50 Discussion

12:30 Adjournment

Soil Mechanics and Foundations Division

EAST BALLROOM

Frank A. Marston, Chairman, Executive Committee, Soil Mechanics and Foundations Division, Presiding

9:30 Introductory Remarks—Mr. Marston

10:00 Excavation Slopes for an Improved Panama Canal

W. V. BINGER, Assoc. M. ASCE, Chief, Soils & Geology Branch, Missouri River Division, Corps of Engineers, D.A., Omaha, Nebr., formerly Chief, Soils and Foundations Section, The Panama Canal; and THOMAS F. THOMPSON, Affiliate ASCE, Chief, Geology Section, Special Engineering Division, The Panama Canal.

10:45 Strength of Soils under Dynamic Loads—Harvard Investigations for Panama Canal

DR. ARTHUR CASAGRANDE, M. ASCE, Gordon McKay Professor of Soil Mechanics and Foundation Engineering, Graduate School of Engineering, Harvard University, Cambridge, Mass.; and W. L. SHANNON, Assoc. M. ASCE, Research Associate, Soil Mechanics, Harvard University, Cambridge, Mass.

11:30 Discussion

Structural Division

WEST BALLROOM

E. L. Durkee, Chairman, Executive Committee, Structural Division, Presiding

Program prepared under the direction of the Committee on Applied Mechanics

10:00 Framework Method and its Technique for Solving Plane Stress Problems

ALEXANDER HRENNIKOFF, Assoc. M. ASCE, Associate Professor of Civil Engineering, University of British Columbia, Vancouver, B.C.

10:45 Computation of Buckling Loads by Finite Differences

MARIO G. SALVADORI, Assoc. M. ASCE, Instructor, Civil Engineering, Columbia University, New York, N. Y.

11:15 Discussion

Construction Division

ROOMS B AND C

Kirby Smith, Chairman, Executive Committee, Construction Division, Presiding

Construction Planning and Methods for an Improved Panama Canal

J. J. ROSE, W. B. WATSON, L. T. CROOK, AND F. L. DYE, Engineers, Special Engineering Division, The Panama Canal.

FIRST SESSION

10:00 General Statement, Flood Control Structures and Tidal-Regulating Structures

10:40 Discussion

11:10 Lowering Gatun Lake

11:50 Discussion

12:30 Recess for Luncheon

CONSTRUCTION DIVISION LUNCHEON

Thursday—12:30 p.m.

This luncheon has been arranged under the auspices of the Executive Committee of the Construction Division and all members of the Society, whether or not members of the Division, are welcome to attend. Tickets: $3.50 each.

Sessions of Technical Divisions—Thursday Afternoon

Construction Division

ROOMS B AND C

Kirby Smith, Chairman, Executive Committee, Construction Division, Presiding

Construction Planning and Methods for an Improved Panama Canal

J. J. ROSE, W. B. WATSON, L. T. CROOK, AND F. L. DYE, Engineers, Special Engineering Division, The Panama Canal.

SECOND SESSION

2:30 Dry Excavation, Including Machinery

3:00 Wet Excavation, Including Machinery

3:30 Discussion

Sanitary Engineering Division

MAIN BALLROOM

Gordon M. Fair, Chairman, Executive Committee, Sanitary Engineering Division, Presiding

Symposium on Sewage Disposal Into Tidal Rivers and Estuaries

2:00 At Boston, Mass.

KARL R. KENNISON, M. ASCE, Chief Engineer, Metropolitan District Commission, Commonwealth of Massachusetts, Boston, Mass.

2:30 At New York, N.Y.

RICHARD H. GOULD, M. ASCE, Director, Division of Engineering, Department of Public Works, New York, N.Y.

3:00 At Philadelphia, Pa.

M. B. TARK, M. ASCE, Sanitary Engineer, Link-Belt Co., Philadelphia, Pa., and S. S. BAXTER, M. ASCE, Bureau of Engineering, Surveys and Zoning, Philadelphia, Pa.

3:30 Discussion

3:45 Report of the Committee on Sewerage and Sewage Treatment

LANGDON PEARSE, M. ASCE, Sanitary Engineer, The Sanitary District of Chicago, Chairman.

4:15 Discussion

4:30 Adjournment

Joint Session—Soil Mechanics and Foundations Division and Air Transport Division

EAST BALLROOM

Frank A. Marston, Chairman, Executive Committee, Soil Mechanics & Foundations Division, Presiding

Alfred J. Ryan, Chairman, Executive Committee, Air Transport Division, Presiding

Program arranged by the Committee on Airfield Foundations

2:00 Full-Scale Research on the Design of Concrete Pavements and Their Foundations

ROBERT R. PHILIPPE, Assoc. M. ASCE, Head Engineer, Ohio River Division Laboratories, Department of the Army, Mariemont, Ohio.

2:30 Discussion

A. A. ANDERSON, Assoc. M. ASCE, Portland Cement Association, Chicago, Ill.; HAROLD M. WESTERGAARD, M. ASCE, Gordon McKay Professor of Civil Engineering, Graduate School of Engineering, Harvard University, Cambridge, Mass.

3:00 Vertical Sand Drains for Stabilization of Compressible Foundations

O. J. PORTER, M. ASCE, Consulting Engineer, Sacramento, Calif., and New York, N.Y.

3:30 Discussion

THOMAS A. MIDDLEBROOKS, Assoc. M. ASCE, Head Engineer, Corps of Engineers, Chief, Soil Mechanics, Geology and Geophysical Section, Washington, D.C.

4:00 General discussion

4:30 Adjournment

Thursday Afternoon Reception, Tea and Fashion Show for Ladies

CENTURY ROOM, HOTEL COMMODORE—3:00 P.M.

Committee: Herbert Ridgway, Chairman, John P. Riley and Arthur A. Collard

The Century Room at the east end of the main lobby of the Hotel Commodore has been reserved for a Thursday afternoon Reception and Tea for the ladies. Reception will be at 3:00 p.m. Tea will be served at 3:30 p.m. Tickets $3.00 each.

Following the tea, a fashion show will be sponsored by Arnold Constable, the well-known Fifth Avenue store. The showing will be under the direction of Anne Albee, their Fashion Director, who will present the spring trends of 1948. A question and answer period will be held at the conclusion of the showing.

Structural Division

WEST BALLROOM

E. L. Durkee, Chairman, Executive Committee, Structural Division, Presiding

Program prepared under the direction of the Committee on Applied Mechanics

2:00 Live Loads for Highway Bridges Based on the Chance Grouping of Heavy Trucks in Traffic

HENSON K. STEPHENSON, M. ASCE Associate Professor and Research Engineer, Civil Engineering Dept., Agricultural and Mechanical College of Texas, College Station, Tex.

2:40 Applied Column Theory

F. L. SHANLEY, Consulting Engineer, Los Angeles, Calif.

3:20 Design Criteria for Beams with Semi-Rigid Connections

BRUCE G. JOHNSTON, M. ASCE, Professor of Civil Engineering, Associate Director, Fritz Engineering Laboratory, Lehigh University, Bethlehem, Pa.

ROBERT A. HECHTMAN, Assoc. M. ASCE, Research Engineer in Civil Engineering, University of Illinois, Urbana, Ill.

4:00 Discussion

Dinner-Smoker for Men—Thursday Evening—Hotel Commodore, Grand Ballroom

Committee: Ralph W. Atwater, Chairman, John P. Riley and John M. Buckley

6:30 Dinner 8:30 Entertainment

The Annual Dinner-Smoker will be held on Thursday evening in the Grand Ballroom of the Commodore Hotel. Dinner will be served promptly at 6:30 p.m. and will be followed at 8:30 p.m. by an interesting program of entertainment. **LADIES TICKETS:** Because of the anticipated interest of ladies in the entertainment to be provided at the Dinner-Smoker, ladies will be admitted for the entertainment to begin at 8:30 p.m. Ladies' tickets are $1.00 each. These tickets are to be presented at the balcony of the Ballroom at the Commodore between 8:15 p.m. and 8:30 p.m. Members' tickets, $6.00; Guest tickets, $7.50; Ladies tickets, $1.00.

Sessions of Technical Divisions—Friday Morning

Hydraulics Division

EAST BALLROOM

Lorenz G. Straub, Chairman, Executive Committee, Hydraulics Division, Presiding

9:30 Flood Control for a Panama Sea-Level Canal

F. STEWART BROWN, Assoc. M. ASCE, Chief, General Engineering Branch, Special Engineering Division, The Panama Canal.

10:00 Tidal Currents in a Panama Sea-Level Canal

STUART MEYERS, Assoc. M. ASCE, and E. A. SCHULTZ, Assoc. M. ASCE, Engineers, Special Engineering Division, The Panama Canal, Diablo Heights, C.Z.

10:30 Discussion

Power Division

WEST BALLROOM

Joel D. Justin, Chairman, Power Division, Presiding

9:30 Opening Remarks—Joel D. Justin

9:40 Cost Trends in Steam-Electric Power Generation

EDWIN H. KRIEG, Consulting Mechanical Engineer, American Gas and Electric Corp., New York, N.Y.

10:25 Discussion

10:45 Cost Trends in Hydroelectric Power Generation

MILTON G. SALZMAN, M. ASCE, Civil Engineer, Ebasco Services, Inc., New York, N.Y.

11:30 Discussion

Highway Division

GRAND BALLROOM

Charles M. Upham, Chairman, Executive Committee, Highway Division, Presiding

9:30 Panel Discussion of "Toll Highways"

1. ENOCH R. NEEDLES, M. ASCE, Consulting Engineer, Howard, Needles, Tammen and Bergendoff, New York, N.Y.

2. H. S. FAIRBANK, Deputy Commissioner, Public Roads Administration, Washington, D.C.

10:10 Discussion

Sessions of Technical Divisions—Friday Afternoon

City Planning Division

ROOMS B AND C

Frank H. Malley, Chairman, Executive Committee, City Planning Division, Presiding

2:30 Urban Patterns of Tomorrow

MABEL L. WALKER, Executive Director, Tax Institute, New York, N.Y.

3:15 Discussion

Hydraulics Division

EAST BALLROOM

Lorenz G. Straub, Chairman, Executive Committee, Hydraulics Division, Presiding

2:30 Symposium on High-Velocity Flow in Open Channels

1. Supercritical Flow in Open-Channel Contractions

ARTHUR T. IPPEN, Assoc. M. ASCE, Associate Professor of Hydraulics, Department of Civil and Sanitary Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

2. Design of High-Velocity Curves

ROBERT T. KNAPP, M. ASCE, Professor of Hydraulic Engineering, California Institute of Technology, Pasadena, Calif.

3. Open-Channel Expansions for Supercritical Flow

HUNTER ROUSE, M. ASCE, Director, Iowa Institute of Hydraulic Research, State University of Iowa, Iowa City, Iowa.

4:00 Discussion

Power Division

WEST BALLROOM

Joel D. Justin, Chairman, Executive Committee, Power Division, Presiding

1:30 The Nantahala Earth-Faced Rock-fill Dam

JAMES P. GROWDEN, M. ASCE, Chief Hydraulic Engineer, Aluminum Company of America, Pittsburgh, Pa.

2:15 Discussion

WILLIAM P. CREAGER, M. ASCE, Consulting Engineer, Buffalo, N. Y.

PAUL BAUMANN, M. ASCE, Chief Engineer, Los Angeles County Flood Control District, Los Angeles, Calif.

2:25 Discussion

2:35 Diversion Tunnel and Power Conduit of Nantahala Hydroelectric Development

DONALD J. BLEIFUSS, Assoc. M. ASCE, Engineer, Morrison-Knudsen Co., Inc., San Francisco, Calif.

3:20 Discussion

3:40 Rehabilitation of Barker Dam

RAYMOND E. DAVIS, M. ASCE, Director, Engineering Materials Laboratory, University of California, Berkeley, Calif.

4:25 Discussion

Waterways Division

GRAND BALLROOM

W. W. DeBerard, Chairman, Executive Committee, Waterways Division, Presiding

An Improved Panama Canal

2:00 Investigation of Ship Performance in Restricted Channels

C. A. LEE, Jun. ASCE, Bethesda, Md., and C. E. BOWERS, Jun. ASCE, Hydraulic Engineers, David Taylor Model Basin, Washington, D.C.

2:45 Design of Channel for a Sea-Level Canal

J. E. REEVES, Assoc. M. ASCE, E. H. BOURQUARD, Jun. ASCE, Engineers, The Panama Canal Special Engineering Division, Diablo Heights, C.Z.

3:15 Panama Canal Traffic and Capacity

RALPH P. JOHNSON, Assoc. M. ASCE, and S. O. STEINBORN, Assoc. M. ASCE, Engineers, Special Engineering Division, The Panama Canal.

4:00 Discussion

Boat Excursion—Saturday Forenoon

Committee: Irving F. Ashworth, Chairman, Nomer Gray, Charles B. Molineaux, Raymond L. Brandes

10:00 a.m. Leave West Shore Ferry Terminal

A sightseeing excursion by ferry boat has been arranged for Saturday. The boat will leave the West Shore Ferry Terminal at the foot of West 42d Street at 10:00 a.m. sharp, proceeding up the Hudson River for a view of the George Washington Bridge. On the return the excursion will cross the upper bay to the Narrows and then proceed up the East River as far as the New York Navy Yard. The party will then return to the starting point at West 42d Street. The trip is expected to end about 3:00 p.m. A box luncheon will be served aboard. Tickets $2.50 each, including luncheon.

General Announcements

Headquarters Hotel

The Commodore Hotel has been designated as the Headquarters for the Annual Meeting. Because of the scarcity of hotel rooms it is important that reservation requests be made as early as possible in advance of departure for New York. The Hotel Commodore has agreed to make a certain number of rooms available. Requests for reservations at the Commodore should state that they are for attendance at the ASCE Annual Meeting and should be addressed to the attention of Mr. Henry L. Dienna, public relations. The hotel will mail confirmation of reservations direct to members.

Your New York Address

A file of those in attendance will be maintained at the Registration Desk with information as to members' hotel addresses in New York. Members are requested to keep the Registration Desk informed as to their New York addresses so as to expedite the delivery of telegrams, telephone messages and mail.

Committee on Local Arrangements for the Annual Meeting

M. N. Quade, *Chairman*
Edward J. Cleary, *Vice-Chairman*
Alfred Hedefine, *Past-Chairman*

Irving F. Ashworth	L. H. Csanyi
Ralph W. Atwater	Nomer Gray
Brother B. Austin Barry	Wm. S. LaLonde, Jr.
Raymond L. Brandes	Charles B. Molineaux
John M. Buckley	Herbert Ridgway
Arthur A. Collard	John P. Riley

Ladies Committee

Mrs. M. N. Quade, *Chairman*

Mrs. Roger W. Armstrong	Mrs. Nomer Gray
Mrs. Ralph W. Atwater	Mrs. Shortridge Hardesty
Mrs. Raymond L. Brandes	Mrs. Alfred Hedefine
Mrs. Charles W. Bryan, Jr.	Mrs. Irving V. A. Huie
Mrs. John M. Buckley	Mrs. William S. LaLonde, Jr.
Mrs. William N. Carey	Mrs. Harry O. Locher
Mrs. Edward J. Cleary	Mrs. Charles B. Molineaux
Mrs. Arthur A. Collard	Mrs. John P. Riley
Mrs. L. H. Csanyi	Mrs. Thorndike Saville
Mrs. Morris M. Goodkind	Mrs. Charles E. Trout

Ladies Headquarters

The "Club Suite" on the third floor of the Hotel Commodore has been reserved as Ladies Headquarters for the duration of the Annual Meeting.

There, the ladies will find a convenient place for meeting their friends, planning their activities, playing bridge, etc. Members of the Ladies Committee will be on duty to assist with advice on shopping and sight-seeing. The ladies are invited to make full use of their headquarters.

AMERICAN SOCIETY FOR ENGINEERING EDUCATION

A meeting of the Civil Engineering Division of the ASEE will be held in New York on Thursday, January 22nd at 10 a.m., in the Commodore Hotel. All engineering educators and others interested in education are welcome. Important Division business will be discussed.

20th Annual Meeting, New York State Sewage Works Association

HOTEL PENNSYLVANIA, NEW YORK CITY

FRIDAY—JANUARY 23, 1948

8:30 a.m. Registration

9:30 a.m. Annual Business Meeting
Committee Reports
Reports of Tellers on Canvass of Ballots

MORNING TECHNICAL SESSION

Symposium on Chlorination of Sewage

10:30 a.m. A Statistical Approach to the Chlorination of Sewage

AUSTIN HELLER, Research Associate; HERMAN L. KRIEGER, Research Fellow; and ROLF ELIASSEN, Professor of Sanitary Engineering; New York University, New York, N.Y.

11:00 a.m. Practical Design and Operation in Chlorination of Sewage

J. W. JOHNSON, Works Superintendent, Buffalo Sewer Authority, Buffalo, N.Y.

11:30 a.m. Survey of State Department of Health Regulations for Chlorination of Sewage

HARRY A. FABER, Research Chemist, The Chlorine Institute, Inc., New York, N.Y.

12:30 p.m. Luncheon, Hotel Pennsylvania

Presentation of Awards

Guest Speaker, JOHN C. BRIGHAM, Senior Sanitary Engineer, New York State Dept. of Health.

AFTERNOON TECHNICAL SESSION

2:45 p.m. Industrial Waste Pollution Abatement Program for Buffalo, N.Y.

GEORGE E. SYMONS, Consultant, New York, N.Y.; GEORGE F. FYNN, Chief Chemist; and HOWARD BROWN, Research Chemist; Buffalo Sewer Authority, Buffalo, N.Y.

3:15 p.m. Discussion—Pilot Plant for Coke Plant Wastes

NEWELL L. NUSSBAUMER, Consulting Engineer, Buffalo, N.Y.

3:30 p.m. Practical Results of Step Aeration

WILBUR N. TORPEY, Civil Engineer, Department of Public Works, New York City.

4:30 p.m. Adjournment

5:00–6:00 p.m. Social Hour—Manhattan Room, Hotel Pennsylvania

Courtesy of the Water and Sewage Works Manufacturers Association, Inc.

SATURDAY—JANUARY 24

Boat Excursion—Members of the New York State Sewage Works Association will join the boat trip arranged for members of the American Society of Civil Engineers.

Virginia Launches Record Highway Reconstruction Program

Twenty-Year Plan Calls for Half-Billion-Dollar Expenditure. Multimillion-Dollar Shirley Memorial Highway—Virginia's First Superhighway—Is Scheduled for Completion in 1949.

WITH TRAFFIC on Virginia's highway system already reaching new peaks and destined to soar to yet greater figures, the greater part of the Old Dominion's main-stem transportation network—her primary system of highways—stands indicted in this postwar era as "obsolete and inadequate" in the light of present and future demands of automotive transport. Fully recognizing the urgency of the situation, Virginia Highway Department officials are launching a record reconstruction program on the state's main roads. Millions from the state, supplemented by federal aid, will be spent to modernize the more important highways. Sections of some roads will be torn out completely, some will be relocated and others widened and strengthened. Already under construction is the multimillion-dollar Henry G. Shirley Memorial Highway, the state's first superhighway.

OBSOLETE AND INADEQUATE, such is the studied opinion of veteran engineers of the Virginia State Highway Department, the opinion of men who in their lifetime have seen the inner workings and culmination of a strange highway paradox—a paradox that has left the greater part of Virginia's primary system of highways in a state of obsolescence. The engineers behind Virginia's highways have long been cognizant of the paradox. They have seen it developing, have foreseen the final effect. But so relentless were its workings that they were powerless to stay its results.

Beginnings of the paradox go back to 1920 when the automobile was assuming its definite place in the everyday life of America; thousands of private automobiles, trucks and buses were slogging through mud-bound highways that were inadequate for even the horse and buggy era at the turn of the century. Highway departments throughout the nation faced the staggering job of putting into immediate use thousands of miles of serviceable paved roads, roads that were hastily constructed to carry heavy traffic between large centers of population.

There was no time for planning. The roads were constructed as speedily and as simply as the terrain permitted. Scattered towns and cities were connected, even though by so doing highways were routed far from their logical courses. Virginia's infant Department of Highways met this early demand for roads, and made progress as the nation struggled to keep pace with the rapid development of the motor vehicle. Cities and towns of the Old Dominion were linked with roads that served the traffic of the times. Many of these original rights-of-way—and some of

GRADING OPERATIONS on Virginia's Shirley Memorial Highway are expedited by high-speed Euclid Loader. Completion date for highway that will relieve traffic congestion south of nation's capital is set for early in 1949. Grading work involves moving nearly 3,000,000 cu yd of earth. Multimillion-dollar highway, to be state's finest, will tie in with 2.2-mile section built by federal government in 1942 that leads directly to Potomac River bridges into Washington. Fifteen-mile road has two 24-ft-wide roadways paved with 10-in.-thick concrete.

the roads themselves—are still vital links in a highway system that is now far behind the times.

Sharp curves which were safe 20 years ago are threats to the high-speed traffic of today; steep grades that stretch in roller-coaster fashion over hill and dale cause inadequate sight distances for the motorist of 1947. Railroad grade crossings pose constant threats to highway safety and pedestrian safety demands sidewalks in the thickly settled sections.

These are the major needs on Virginia's 9,000-mile primary highway network. Much, too, remains to be done on the rural and connecting roads that comprise the secondary system. But it is the primary system, totaling less than 20 percent of all road mileage in Virginia, and carrying 80 percent of the traffic, that most urgently needs modernization. It must be safe for the traffic of today and anticipated traffic of tomorrow.

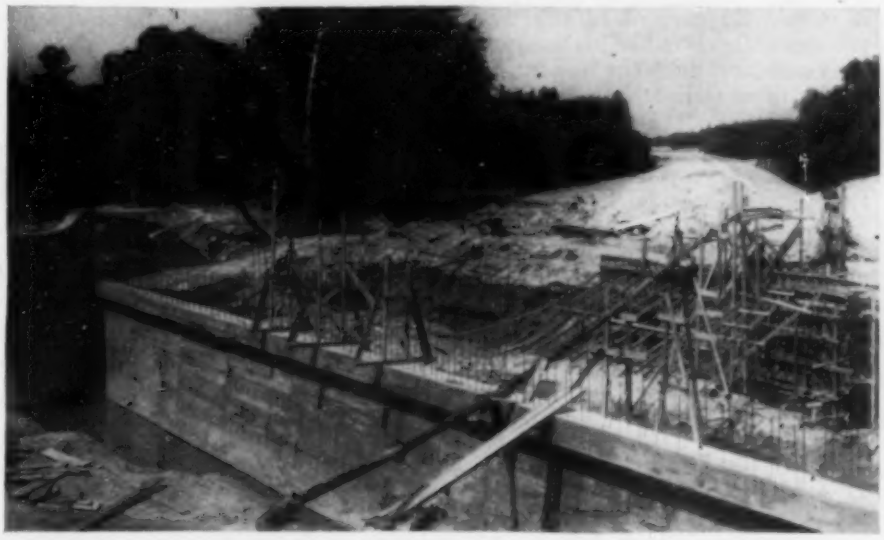
Twenty-Year Improvement Plan

Determined to avoid a second working of the paradox which brought about this condition of obsolescence, the Highway Department two years ago submitted to the General Assembly a "20-Year Plan" for the improvement and modernization of Virginia's highways—primary, secondary, and urban. Slated to go into operation during the first year after the war, this plan anticipated the highway needs of 20 years hence, outlining the basic essentials on which to project an adequate transportation system for those who travel tomorrow's highways.

Along with detailing the requirements for an adequate main highway system, the plan incorporates improvements on the secondary system and on state highway extensions through municipalities. Vast strides were made last year toward the goal of "getting Virginia out of the mud"; more progress will be made this year. But postwar traffic increases have far exceeded all expectancies, overtaxing the main arteries and making even more serious the obsolescence of the network of trunk highways.

The Highway Department this spring launched a record reconstruction program on its main roads. With considerable federal aid, it will spend millions in an attempt to modernize the more important roads; sections of some are destined to be torn out completely, others will be relocated, others widened and strengthened. Highway officials realize that in some cases this huge program may on the surface appear unnecessary for 1947. But they know it is justified.

THREE-LEVEL UNDERPASS-OVERPASS, scheduled for completion next year, will eliminate serious traffic bottleneck in Norfolk County at intersection of Routes 13 and 460 and will forge final link in four-lane bypass around city of Norfolk. Route 13 (Norfolk bypass) crosses at top level, with routes 460 and 166Y passing beneath Norfolk & Western Railroad tracks. Connecting road runs on plane of railroad track. Artist's conception of interchange (above), by Francis Wiley Powell of Virginia State Highway Department, is drawn to scale from engineering blueprints.

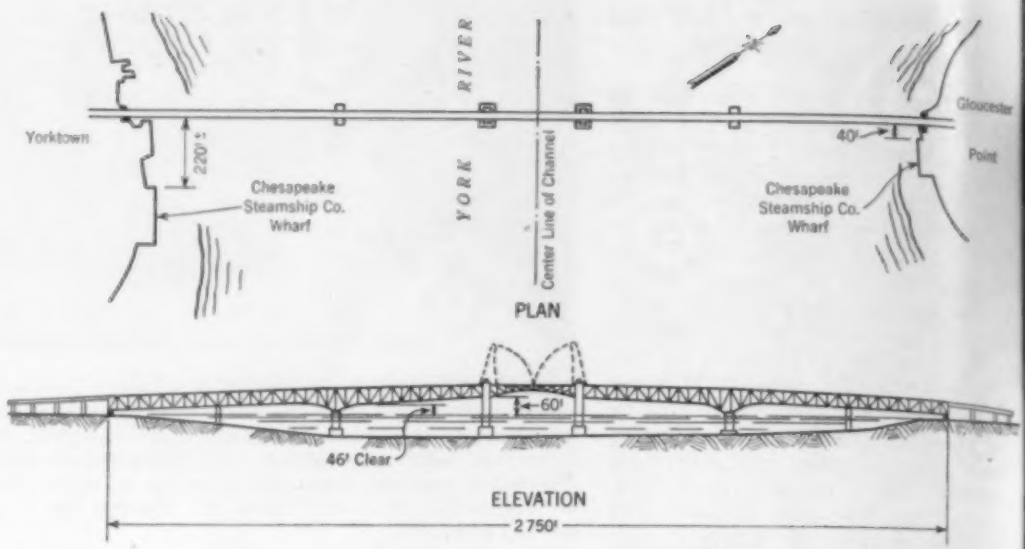


REINFORCED CONCRETE abutments are constructed for Accotink Creek Bridge, 104-ft, two-span concrete structure on Shirley Memorial Highway. Forms are dewatered by means of gasoline-powered pump (background) and steel pipeline (foreground). Fill for controlled-access highway can be seen in background.

There are stretches of paved road—in some respects capable of carrying today's traffic—that must be torn out. But there is no doubt that their improvement is justified. Such roads are hazardous to modern traffic and must be rebuilt even though the expenditure may appear incongruous to the farmer who is still living on a mud road. The farmer must realize that his mud road is carrying less than a dozen cars a day while a through highway carries thousands. A case at hand is the project undertaken this spring in the Richmond area where an important heavily traveled road with its recurring steep grades and poor sight distances is obsolete and dangerous for the traffic it carries today.

BRINGING VIRGINIA'S ROADS
to adequate modern standards will cost conservatively a half billion dollars, spread out over the 20 years covered by the highway department's 20-year plan. Revenues will come from state-imposed gasoline taxes with expenses distributed on a "pay-as-you-go" policy. Federal aid should help substantially.

A record 19-million-dollar secondary program last year and comparable improvements planned for the current year are ample assurance that the farmer and his mud road are not being neglected while primary roads are being improved. Cold, hard facts back up the expenditures on the primary system. Although this network comprises less than 20 percent of the entire road mileage of Virginia,



PRELIMINARY PLANS for five- to six-million-dollar bridge over York River between historic Yorktown and Gloucester Point call for double-leaf bascule-type drawbridge. Bids may be sought this winter, after final plans are prepared. Consulting engineers are Parsons, Brinckerhoff, Hogan & Macdonald of New York. Objections to high-level plan arose on grounds that span would be visible from Yorktown battlefield site and would detract from historic atmosphere. Navy authorities recently withdrew objections to low-level span.

it carries 80 percent of the traffic, produces 80 percent of highway revenues and must take the responsibility for far more than 80 percent of highway fatalities. The top 50 percent of this mileage alone carries 82 percent of all primary system traffic. It is this mileage that is demanding priority.

The 20-Year Plan is the guide for all current work, representing the culmination of nine years of traffic, engineering, and economic research. The plan is flexible and is kept constantly up to date as Virginia's road picture changes with time. Enormous amounts of factual data, compiled in cooperation with the U.S. Public Roads Administration, went into the plan.

Shirley Memorial Highway

The most ambitious highway project in Virginia's 20-year plan—the 17.3-mile, half-billion-dollar Henry G. Shirley Memorial Highway—may be serving traffic by early 1949, state highway department officials estimate. The Old Dominion's first superhighway will relieve congestion on U.S. Route 1, bypass the city of Alexandria and slash miles and minutes from north-south motoring timetables in busy Fairfax County, south of the nation's capital.

High costs, material and labor shortages and strikes that have delayed progress in highway industries in general are having their effect on the Shirley Highway construction. A 2.2-mile section of the expressway between the Pentagon Building network and the Alexandria-Leesburg Highway, Route 7, was completed by the federal government in 1942. The remaining 15-mile stretch between Route 7 and the Route 1 connection at Woodbridge is now under construction.

The expressway is named in honor of the late Henry G. Shirley, M. ASCE, Virginia highway commissioner for 22 years, who died in 1941 a few weeks after giving the go-ahead signal for the project. Wartime shortages, however, forced postponement of a major part of the project until October 1945.

An estimated 80 percent of the traffic on U.S. 1 between Woodbridge and Washington, the most heavily traveled highway on the eastern seaboard south of the District of Columbia, will be carried by the new expressway. Passenger vehicles will save 3.4 miles of travel over that required on the old route between Washington and Richmond. An alternate truck route into Washington cuts off 2.4 miles for heavy trucks.

Traffic surveys indicate that a peak of 30,000 vehicles per day will travel the northern end of the highway, dwindling to more than 10,000 on the southern extremity near Woodbridge. The limited-access characteristic of the Shirley Memorial Highway, ruling out a crossing of traffic lanes and permitting vehicles to leave or enter only via controlled interchanges, will save many lives.

VIRGINIA'S 20-YEAR PLAN does not call for the construction of any three-lane highways. On the basis of extensive studies, Department engineers have concluded that in cases where a highway must have more than two lanes, it is in the interest of both safety and economy to progress directly from the two-lane to the divided four-lane road. The nation's highway and traffic engineers hold varying opinions on this subject, with considerable argument on both sides of the issue, but in general Virginia has ruled out future construction of the three-lane road.

The highway will leave Route 1 at Occaquan Creek, immediately north of Woodbridge on the Fairfax–Prince William County line. Following the R. F. & P. Railroad tracks for several miles, it will swing northward to Route 7, tying in with the completed portion of the highway that feeds traffic through the Pentagon network directly to the Memorial Bridge into Washington.

Interchanges of Various Types

Nine points of controlled access will permit traffic to enter or leave the highway between Routes 1 and 7. An elaborate cloverleaf, second of its type in the state, will be constructed at the intersection of Route 236. Future cloverleaves may be erected later at the intersections of Route 7 and a secondary highway, Fairfax County Route 644. Other interchanges, including an intricate connecting link with U.S. 1 at Woodbridge, will be of nearly every type known to modern highway design.

There will be a total of 16 structures on the highway, among them railroad crossings, bridges and a pedestrian underpass for the children of Lorton school. Grading of 10.5 miles of the superhighway has already been completed, and bids for paving and construction of traffic interchange structures are now being sought. After completion of all grading, 3,000,000 cu yd of dirt will have been excavated and moved. One slope will rise to a height of 101 ft and a long fill will span a valley 55 ft below.

The actual roadway will consist of two 24-ft concrete traffic lanes, separated by a depressed median strip, varying from 14 to 70 ft in width. Later, if necessary, one additional lane each way can be added on the first five miles at the Washington end. Anticipating heavy truck traffic, de-

GRADING PROCEEDS on west-bound lane of U.S. Route 60 between Richmond and Williamsburg without interrupting traffic on old road at right.

UNOFFICIAL RECORD OF PLACING 2,016 ft of 24-ft reinforced concrete 9 in. deep is set by contractor on Route 60 between Richmond and Williamsburg. Complete construction sequence is pictured here. "Strike-off" machine which levels concrete to 2 in. below forms is followed by finishing machine which smooths concrete transversely. Longitudinal float, preceding cutting and finishing machine, smooths concrete longitudinally. Final piece of equipment sprays curing ingredients on finished pavement. Railroad rails along which machines roll act as forms for slab.

BOTTLENECKS such as this narrow underpass take high priority in planned improvement under Virginia's modernization program. Modern underpass and overpass construction at railroad crossings is part of safety program aimed at reducing annual toll of lives.

CONSTRUCTION OF 6.8 miles of standard two-lane highway through rocky mountainous country in southwest Virginia eliminates S-curve and narrow, crooked road on Route 64 at cost of approximately $700,000.

RECENTLY COMPLETED section of roadway on U.S. Route 60 is part of 20 miles of dual-lane construction that replaces 1920-vintage highway at a cost of approximately $3,000,000. Modern road-building practices, though more expensive, are far superior to those of past decades. These roads, with better alignment and proper drainage, will outlive by many years their more cheaply constructed counterparts.

ATTRACTIVE DUAL-LANE HIGHWAY, U.S. Route 50—one of Virginia's earliest—handles up to 10,000 vehicles per day. Pavement is bituminous plant-mix on gravel to 14-in. maximum depth. Depressed median strip is 32 ft wide. Section shown was completed in 1938.

signing engineers have called for concrete slabs 10 in. thick. The highway, which has a design speed of 70 mph, will include a series of gradual curves to reduce headlight glare of opposing traffic to a minimum.

Some work has been done on construction of service roads, which will parallel the main highway, feeding traffic from residential areas to the access points. At present, roughly 10 miles of such roadway is planned.

With few exceptions, all right-of-way and survey work has been completed for the entire highway project. About a dozen dwellings will have been moved when the project is completed, including the entire town of Pohick—four houses. A complete tourist camp was among casualties of the expressway; the highway department purchased the camp and used its small tourist houses and building materials in the construction procedure.

Nearly every type of soil was found along the right-of-way, but for the most part the local soil formed an excellent subgrade, compacting satisfactorily.

Continuing Need for Improvement

Studies recently completed by the department's division of traffic and planning reflect progress—but emphasize the continuing definite need for far-reaching improvement if Virginia's highways are to be lifted to modern standards.

Adequate width is considered one of the more important safety and traffic factors by the Highway Department. Studies of the primary system showed the following mileage breakdown by width as of the first of this year:

Highway Width	Mileage
4-lane divided	66.39
4-lane	289.04
3-lane	532.20
22 ft	427.09
20 ft	3,293.55
18 ft	2,817.91
16 ft	1,371.75

Following is a breakdown of widths that must be established before Virginia's primary mileage can be considered adequate for traffic of today and tomorrow:

Class	Highway Width	Mileage
1	24 ft	2,261*
2	22 ft	2,321*
3	20 ft	2,853
4	18 ft	1,741

* Combined mileage of Class 1 and Class 2 (4,582) to include 1,492 miles of divided four-lane highway.

From the first table it will be noted that Virginia now has but 66.39 miles of the modern divided, four-lane, highway. Under the 20-year plan, an estimated 1,492 highway mileage must come under this category. All main intercity and interstate roads (Classes 1 and 2 in the second table) must have a minimum width of 22 ft; those which carry predominately truck traffic (Class 1) must have a minimum of 24 ft. The more heavily traveled sections of the intercity and interstate routes, totaling an estimated 1,492 miles, must be four-lane divided highways.

Virginia will soon require 4,592 miles of road having a width of 22 ft or more, including dual-lane mileage. Figures show that at present only 1,300 miles meet this standard.

Class 1 roads are those intercity and interstate roads that carry predominately trucks and trailers; Class 2 roads are the intercity and interstate routes whose traffic is predominately passenger cars. These heavily traveled highways carry 82 percent of all traffic on the primary system.

Class 3 roads, which must be 20 ft wide, are the heavily traveled local roads. The Class 4 primary highways, requiring a minimum width of less than 20 ft, are the lightly traveled roads. No four-lane highways will be built in either of these classifications, but the improvement program will make them all-weather roads, safe for travel at a reasonable speed.

Four-lane roads are expensive, at times costing in excess of $250,000 per mile. They are held absolutely essential, however, under heavy traffic conditions. On even the best of the two-lane-type highways, interference between vehicles becomes extremely serious when the volume of traffic reaches 800 vehicles per hour. On two-lane roads where ideal straight and level conditions do not exist, appreciable congestion occurs at volumes of from 300 to 400 vehicles per hour.

Adequate width, alone, cannot bring about a modern highway. Many other factors are contributing to the present state of obsolescence on the primary system. On the interstate and intercity highways alone—that small percentage of roads which carries the most of Virginia traffic—there are more than 3,000 curves that fail to meet safety standards of modern design. The highway paradox has left these most important roads filled with the sweeps and bends that came with the necessary haste of original construction.

Also in serious need of attention are the bridges along the highway network. Of nearly 2,200 bridges in the system, about 40 percent are inadequate in width, strength, or overhead clearance. In addition, railroad grade crossings take an annual toll of lives that could be saved with underpass or overpass construction. Another safety factor to which the Department engineers are giving serious consideration is that which concerns the pedestrian. Sidewalks, they feel, would go a long way toward saving the lives of those who travel on foot.

The Highway Department has no visionary scheme for linking the state's cities with limited-access freeways or expressways. That type of road has been held essential only in localities where traffic reaches tremendous proportions. The Highway

(*Continued on page 94*)

Plans for United Nations Headquarters Stress Functional Design

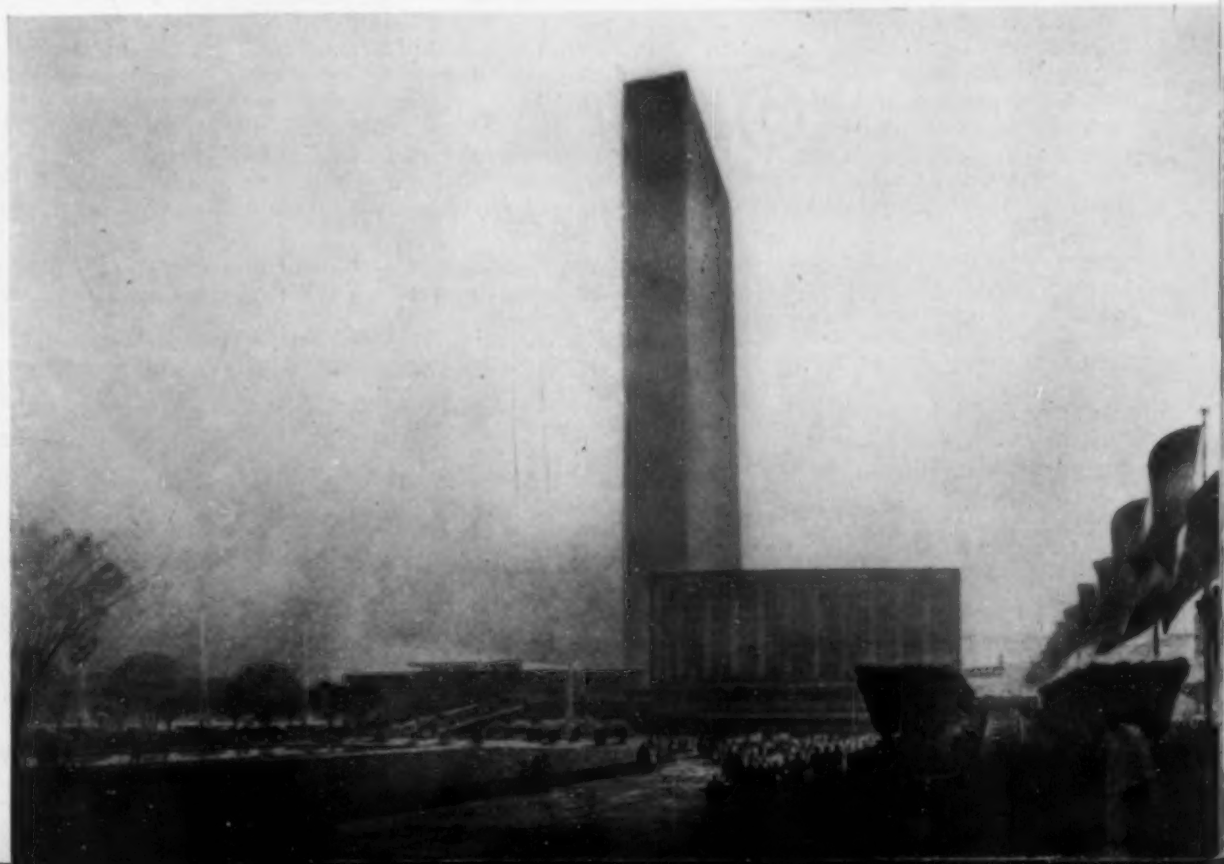
EAST RIVER FRONTAGE of U.N. Headquarters site looking southwest shows artist's conception of landing stage and ramps to main plaza. Conference buildings are on river front, general assembly hall occupies center of plaza, and 40-story secretariat building is in left background.

MAXIMUM UNOBSTRUCTED SPACE and fullest provision for natural lighting are two motifs governing the design and construction of the United Nations Headquarters along New York's East River front in midtown Manhattan. As planned, the proposed home for the world organization consists chiefly of a skyscraper secretariat building, a general assembly hall and a conference building, so designed and laid out as to develop the site with consideration for architectural treatment, scenic possibilities, efficiency of communication, and effectiveness of traffic connections with adjoining arteries of the city.

Concrete-encased steel frame construction for the principal buildings will ensure speed of erection. Construction estimated at about $85,000,000 will be effected in three stages that include the secretariat building, conference building and auxiliary accommodation for immediate social purposes. Erection of the general assembly and theater and a third group of buildings for other social facilities and use of delegations will complete the project as it is now planned.

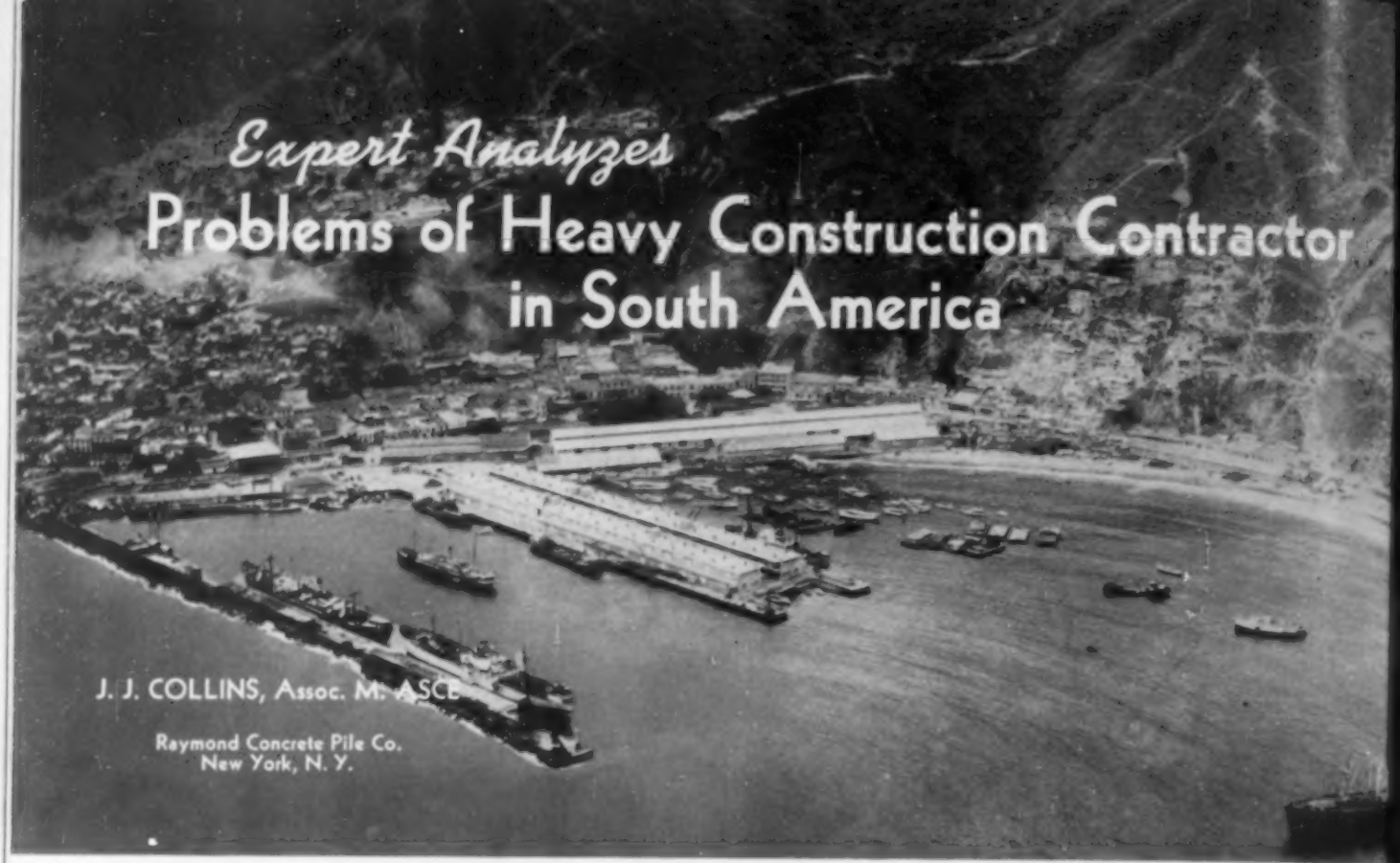
From its western boundary to the river's edge the site will be landscaped in a park-like terrain. Several important improvements, to be made by the City of New York, estimated at approximately $15,000,000, include two formal parks and reconstruction of Franklin Delano Roosevelt Drive. A long-range development is contemplated in the improvement of the river front in Queens directly across from the site to provide a residential area for U.N. personnel.

Among the ASCE members associated with the mammoth project, as consultants in various phases of planning and construction, are: Gilmore D. Clarke, William Mueser, Emil H. Praeger, James L. Edwards and William Wilson.



SKYSCRAPER SECRETARIAT BUILDING, general assembly hall and low-level structures housing conference rooms, committee rooms, and council chambers set architectural motif of proposed design for U.N. Headquarters on New York's East River front in midtown Manhattan. Grounds are landscaped with wide terraces open to public. Forty-story secretariat building is oriented to avoid heavy shadowing of site. Total cost is estimated at $85,000,000 for construction on six-block tract north of 42nd Street.

Expert Analyzes Problems of Heavy Construction Contractor in South America



J. J. COLLINS, Assoc. M. ASCE

Raymond Concrete Pile Co.
New York, N. Y.

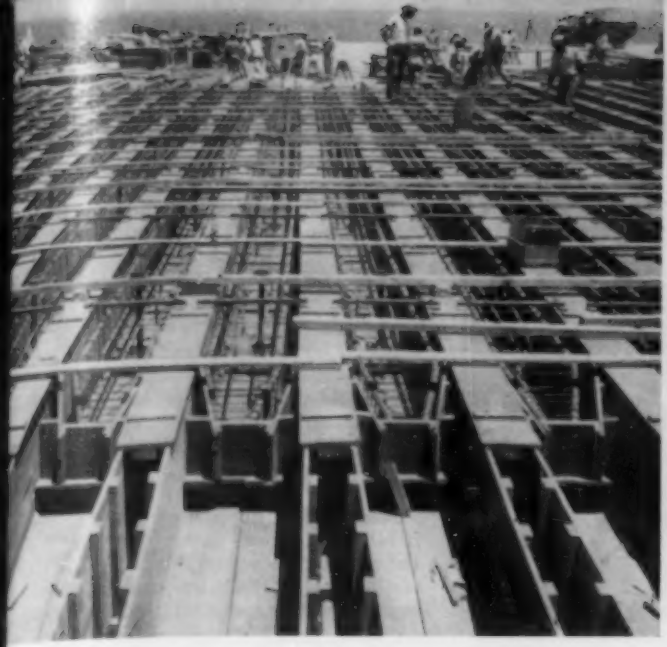
IN ANSWER TO MANY QUESTIONS and as an aid to engineers who may be contemplating foreign service in heavy construction, Mr. Collins has summarized his experiences in South America as a representative of Raymond Conerete Pile Co. over a period of 25 years. His analysis of successful operations outside of the United States includes comments on contracts, financial arrangements, currency, problems of design, transportation, equipment and materials, organizational difficulties, training of skilled workers and education of personnel. Accompanying illustrations show some of the South American construction projects—in practically the entire field of engineering structures—with which the author has been associated.

HEAVY CONSTRUCTION in a foreign country involves problems of financing and negotiation—basic considerations in all business. In all of the work handled by the writer's firm—railroads, roads, housing, warehouses, churches, hospitals, harbor works, power houses, sanitary works, water supply pumping stations, dredging, and breakwaters—each classification has required a different form of contract. The standard forms of contract which are acceptable here in the United States do not meet foreign conditions. In the first place, the oil market or some other market might so seriously change that a project which was economically sound at a certain time might be in an entirely different category a year later.

The owner must have an opportunity to cancel under reasonable and fair terms, and at the same time the contractor must be protected on his commitments. Once a project gets under way in a foreign country the contractor has many commitments which he would not have if it were located in the United States. For instance, organization and manpower drawn from many states are thou-

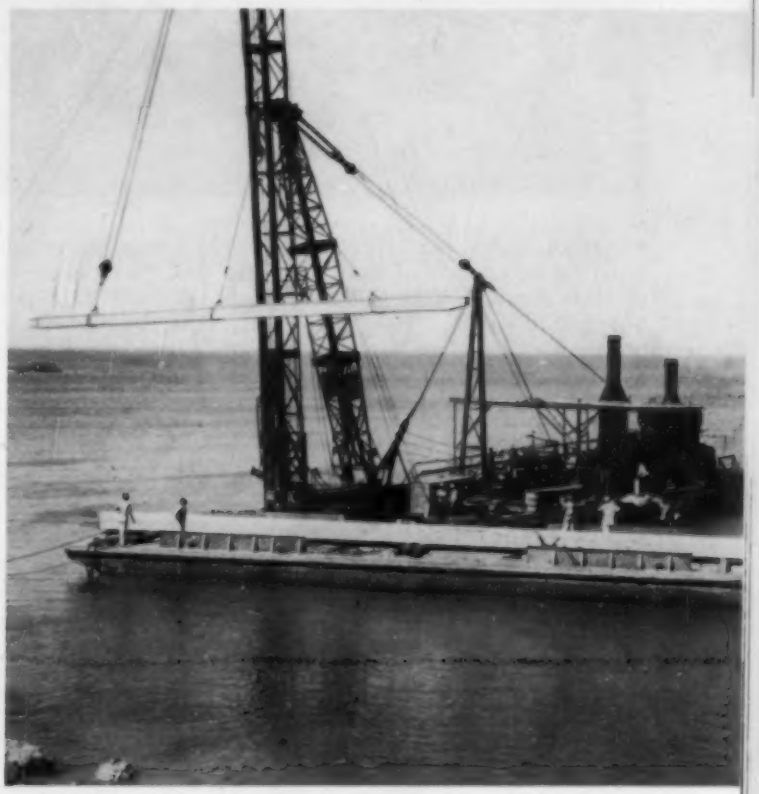
CONCRETE PIER at La Guaira, Venezuela—completed in 1945—increases substantially port's freight handling facilities. Four ocean-going vessels can be berthed at one time. Structure, 1,070 ft long and 237 ft wide, supports two 2-story concrete warehouses, each 840 ft long and 45 ft wide.

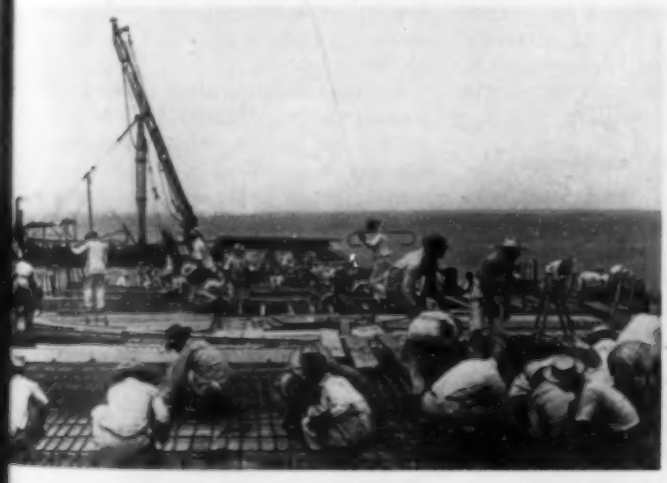
TRAVELING GANTRY (below, left) is erected over casting yard area for handling precast piles for pier at La Guaira, Venezuela. Piles hauled 2 miles by rail are placed by special Raymond universal driver and gantry (below, right), supported on structure piles to avoid interference of operation by high waves.



CONSTRUCTION OF CARDON REFINERY at Punta Cardon on Paraguana Peninsula, Venezuela—immense project for Shell Oil Co. of Venezuela, Ltd.—involves building storage warehouse, workshop and power facilities; complete port facilities and entire new city for workers and their families. Raymond's part of project includes: (1) Two jetties, double decked—lower deck for handling oil and upper deck for cargoes; (2) housing, including 228 residences, school, and market building; (3) erection and operation of crushing plant, central concrete batching plant with fleet of concrete transit mixers, and modern concrete block plant—now well into its third million of production; (4) foundations for powerhouse, salt-water pump house, low- and high-pressure boilers, and 13 industrial buildings; and (5) various municipal facilities including 25 miles of roads and 20 miles of sanitary sewers. Illustrations on this page show details of constructing double-deck jetty at which four ships can be berthed at one time.

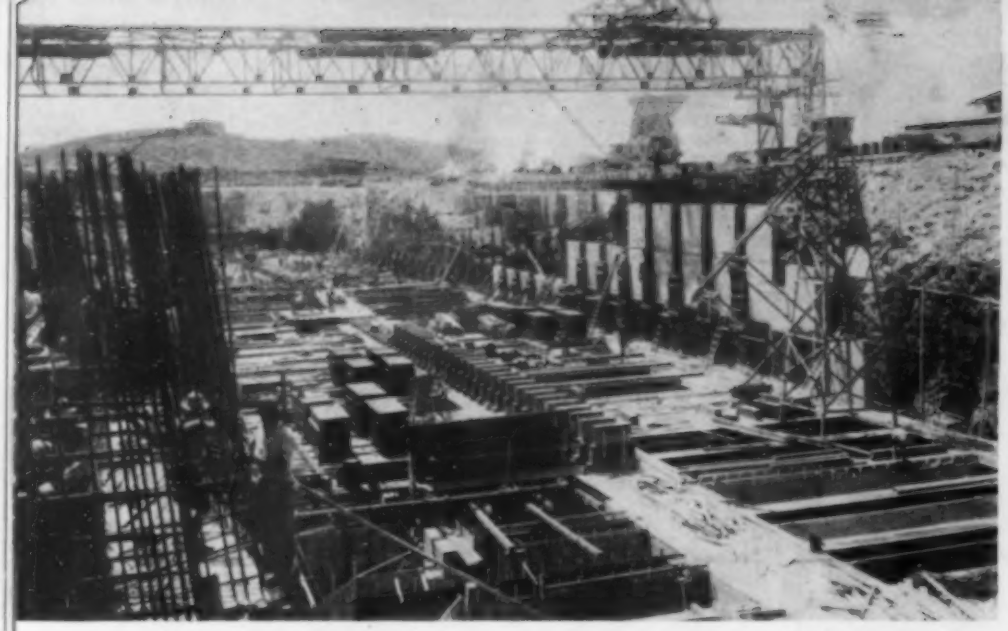
PILE CASTING FORMS (above, left), complete with reinforcing cages, are ready for pouring of concrete. Traveling gantry (above, right) used in handling 2,000 reinforced-concrete piles for two piers, dips pile in creosote bath prior to storing. Casting yard is located near water's edge for convenience in loading piles onto barges and floating to driver (below).





REINFORCING STEEL PLACED IN deck forms (above) is part of 1,832 tons of steel required for 1,515-ft-long by 52-ft-wide structure. Pier is carried on 604 precast piles varying in length from 60 to 110 ft.

UPPER DECK OF COMPLETED PIER—opened to receive ships this past summer—is unobstructed for handling bulk cargoes. Facilities include six 2-ton cranes and three railway lines on main (outer) pier to transport freight direct to warehouses and workshops. Pipelines below deck handle liquid cargoes.



COMPLETE TANKER REPAIR DEPOT at Curacao, Netherlands West Indies—constructed during war by Raymond Co. for N. V. Curacaosche Petroleum Industrie Maatschappij—consists of graving dock 650 ft long overall by 85 ft wide between fenders. Depot has 1,000-ft concrete repair wharf, submarine railway, four small concrete piers, two floating drydock anchorages, office building, warehouses, machine shop, compressor house, pump house and numerous small buildings. Graving dock is founded in solid diabase rock permitting light structure of unusual design. Walls of dock are 1-ft-thick precast slabs anchored to concrete ribs 12 ft on centers. Floor is made up of removable precast slabs. In construction view (left) 165-ft steam-driven gantry, spanning dock and running its entire length, handles precast units. In view below, completed repair depot is pictured servicing tanker.

sands of miles from home. They must be taken care of until they can reach home, and often this may mean a period of weeks. Then there is the question of bringing back equipment or disposing of it, cancellation of contracts, and final settlement of all obligations.

When work is done for American industry there is no question about the type of currency. American capital, even though the contract may be with a foreign subsidiary, pays the engineers or contractors in dollars. This enables the contractor to buy such foreign currency as he may need, and also to take care of his American expenditures. Foreign governments, however, are in a different position. They must buy or provide themselves through exports with such sums in dollars as the contractor or engineer may need for his American expenditures. The contractor is willing to accept in local currency the amount that will be expended locally.

This minimizes the financial problem for the government in question in that it is not required to buy excess dollars. The contractor is also protected against fluctuations in the two currencies. As a result of this situation, practically all the contracts which the writer's firm has made with foreign clients have been in two kinds of currencies—dollars and Bolivares, dollars and pesos, or dollars and sterling as the case might be. This keeps the contractor out of currency speculation, and if his job is properly estimated his monetary requirements are balanced in each country.

Design Is Important Consideration

When matters of financing have been settled, the contractor turns his attention to design. Immediately he faces problems that are not usual at home. First of all he must think of the earthquake situation, which is quite general, and then of natural enemies such as termites, teredo, and corrosion.

Because of the universal presence of termites in Latin America, no wood should be used in construction when it can be avoided. Termites enter structures through microscopic openings, and as is well known, work in their sand tunnels. It is not infrequent for them to completely destroy a building or the furniture in a house before they have been discovered.

The teredo is somewhat similar in destructive ability to the termite except that it is generally to be found in salt water. However, in Lake Maracaibo where the water is so slightly brackish that it can be used in boilers and drunk by cattle, dogs, and other animals, the most vicious of teredo are found. An untreated piece of timber or damaged piece of treated timber is certain of quick destruction by these borers.

Corrosion is another very destructive agent. Normally it is to be expected in areas where salt water breezes or spray come in contact with metal, but in Latin America corrosion of metal seems to be as bad far in the interior as at the seashore. This comes largely from the clay dust that is carried in the air combined with the moisture of the evening or night. Steel doors, windows, and similar structures that are stationary require constant and expensive maintenance.

Transportation from foreign countries is usually expensive, and always expensive within countries where transport facilities are not well developed. This means that designs must be worked out to take full advantage of local deposits of concrete aggregates or of clays suitable for tile products. Also the designer must consider the aptitude of local workmen, and where design duplication or standardization is possible it must be developed to the limit for the greatest simplicity of operation.

Equipment must be imported, but as in the case of design, the less com-

plicated it is the more suitable it is for foreign work. Spare parts are always expensive, and where men must be taught to operate and repair equipment, it must be as nearly foolproof as possible.

Building an Organization

With the contract arranged, finances agreed upon, design approved, and equipment selected, it becomes necessary to select a construction organization. It is by no means true that an outstanding operator in the United States is sure to be a success in foreign fields. Quite the contrary is the case. In selecting members of the organization to serve abroad, age, experience, language aptitude, willingness to live in camp, and the likelihood of long separation from home and family are factors that must be taken into consideration.

It is rarely possible for a man to take his family with him on a foreign construction job. Usually there are no proper living quarters, schools are not available for children, and shopping centers such as American women are accustomed to do not exist.

It has been found that unless a man has been away from the United States previously, it is a great mistake to send him for the first time after he has reached the age of forty. He goes with the best intentions and tries hard, but our experience has shown that we can expect him home in about 90 days. After that age it seems that a man cannot adjust himself to absence from friends and family and cannot adapt himself to tropical conditions. It is of course necessary to explain fully to all those leaving the country just what they can expect in the way of living conditions, what clothes they should wear, etc. Allotments for families must also be arranged.

On the credit side is the fact that the American skilled workman in foreign fields enjoys the advantage of a yearly salary. As those who have been associated with the building trades know, skilled workmen in the United States normally do not work more than 50 percent of the time. With the assurance of a yearly salary less the necessary allowance for his family, an American workman who spends two or three years in a foreign country often secures the funds for the education of a child, the purchase of a new home or something of the kind.

PRECAST CONCRETE SHEETPILE SEAWALL, 14,731 ft long, protects oil field of Venezuela Oil Concessions, Ltd., at Lagunillas, Venezuela, from threatened flooding by Lake Maracaibo, caused by subsiding ground on eastern shore. Sheetpiles, $11^1/_2 \times 24$ in. in section and 34 ft long, are driven at 1 to 8 batter and tied together longitudinally with 24×27-in. concrete beam to form seawall. Back bracing consists of 12×12-in. precast concrete piles, 75 to 85 ft long, with wooden lower sections. Wall is made watertight by pressure grouting, and backfilled when completed. In 1938, because of continued subsidence, wall was heightened and increased in length to 29,126 ft.

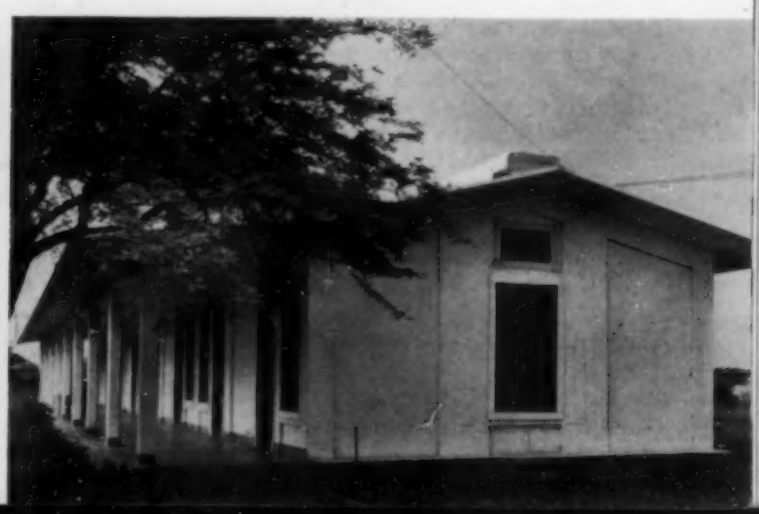
Key Men Train Local Workers

As previously mentioned, certain standards of age and experience are required of the members of an organization sent into a foreign country. Usually we send key men only and depend on training various nationals in the numerous trades required in construction work. If the key men are properly selected, this procedure works out most successfully. The American in a foreign country must approach his problems with a kindly attitude, with patience, and without any show of superiority. Under this type of direction the aptitudes of the local workmen develop rapidly. Most difficulties encountered on jobs in Latin America result from the language barrier. Any attempt to use Spanish, however small or crude, if well intentioned, goes a long way toward improving relationships.

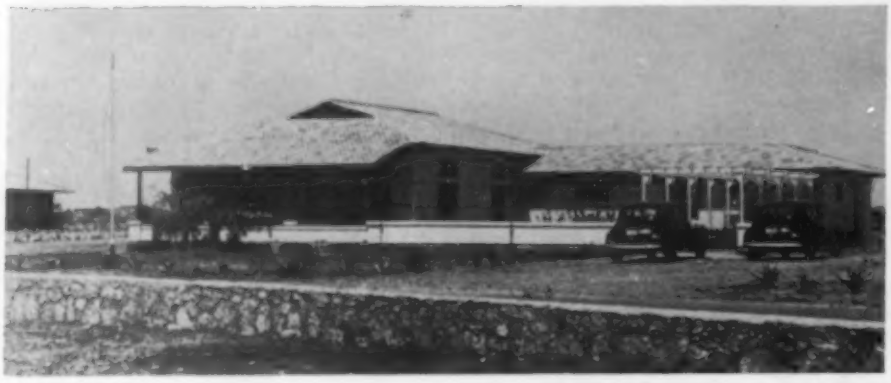
When a local workman learns a new trade he is in a position to improve his standard of living. For this reason the American engaged in construction work abroad derives a sense of satisfaction from it, as he sees that engineering alleviates the misfortunes of mankind instead of profiting by them.

In many trades such as pile driving, concrete work, welding, plastering, structural steel, etc., the local workman readily proves himself capable and carries out his duties with great pride. Perhaps one of the most outstanding performances of local workmen is in oil-well drilling—work re-

FAST AND ECONOMICAL HOUSING CONSTRUCTION (below, left) consists of casting 2-in.-thick concrete wall panels on finished floors, then raising and joining rigidly to poured pilasters and concrete roof slabs. Completed houses (below, right) at Maracaibo, Venezuela—cool and airy in summer—are architecturally pleasing. Poured-in-place roof slabs are entirely impervious to tropical rainstorms. This job was taken in the name of Raymond-Morrison-Knudsen, C.A., but designs and construction were by Raymond Concrete Pile Co.



HOUSING PROGRAM AT PUNTA CARDON, Venezuela, called for steel-frame, concrete-block construction with asbestos-cement roofs (above). Lack of materials resulted in concrete-block construction with wooden doors and windows, wooden roof framing and tile roofs for first 90 houses. Temporary home of Charles P. Louwerse, general manager of Shell at Cardon, (below) is of steel-frame, concrete-block type of construction.



quiring great skill and expert handling of machinery. This is normally outside the field of a foreign contractor, but local workmen have developed into excellent oil-well drillers.

Generally speaking, the standard of work obtained with local labor directed by key personnel from this country is equal to that achieved anywhere in the world. Many of our projects are real show pieces which we are proud to have inspected by engineers of all nations.

Incidentally, in some of the countries "south of the Border" the social labor laws have gone far beyond ours in the United States. For instance, a local workman earning a basic wage equivalent to $4 or $5 a day, gets in the course of a year about a 100 percent increase over this basic wage for the following extras:

He is paid travel time to and from his home or an assembly point near his home, and in addition his transportation is provided. He gets 15 working days of vacation a year. He is paid for 7 days a week providing, however, that he has worked all the working days of the week. If, for instance, he misses one working day without a legally allowed excuse he forfeits his day-of-rest pay. Moreover, he is allowed a percentage of the company's profits, an amount not to exceed $16^2/_3$ percent of his total income for the year. He is also taken care of for certain periods if he has an illness. He is allowed a normal amount if living quarters are not available for him. This brings the total wage level in Latin America, where these laws apply, very close to that in the United States.

Minimize Importation of Materials

As has been mentioned, the writer's firm has found it advisable to avoid the importation of materials wherever possible. Materials that can be obtained locally are chiefly concrete aggregates, sand, clay products, clay roof tile, pressed cement floor tile, etc. However, the question of obtaining these materials, particularly concrete aggregates, is not a simple one. There are no local dealers in these materials, nor are there subcontractors who can supply them. For every large job, it is necessary to locate these materials in the mountains, on islands, along the beach, or elsewhere.

Procurement of materials is a normal part of every project. In the case of stone, it is necessary to open quarries, provide a crusher plant, arrange transportation, build access roads, etc. The same is true of sand. Great care is used in all cases to secure the best possible materials and adjust the design to fit the materials available.

Once in my search for sand, I was having little success. Finally I got a boat and went to many small islands in a lake. I was rewarded, so it seemed, because on the shore of one island I found an ample supply of excellent sand and promptly arranged for small schooners to deliver it. Within thirty minutes of the first delivery I was in jail. The sand was coming from a leper colony. We had to take it out and dump it in a deep part of the lake, get me out of jail and find another source of sand.

Some Materials Come Long Distances

On a project recently built by the writer's firm in Curacao the sand used was imported from Holland. On another project on which we are now working, serious consideration has been given to importing crushed stone from the United States since the limestone available adjacent to the project does not stand the heat requirement. Sand for filter plants is nearly always imported. These materials are frequently available in some part of the country where the project is located but the transportation may be cheaper from the United States or other countries.

At the moment on the Paraguana Peninsula in Venezuela we are using fresh water for boilers and concrete work that is imported from England and Holland. It should be explained that this water is brought back as ballast in tankers. However, some rerouting of ships is necessary and some delay in unloading the water.

Local contacts are of the greatest importance. Business men, lawyers, and engineers are the usual contacts required by a foreign operator. These men usually have very high business standards and ethics, and their cultural level is second to none. A social gathering with these people is on a much higher cultural plane than the average social gathering or cocktail party at home.

In my opinion, we do not take the opportunity to educate Latin Ameri-

(*Continued on page 94*)

Modernization of New York Highways Will Cost State Two Billion Dollars

Ultramodern $200,000,000 Throughway Delayed by High Costs and Shortages

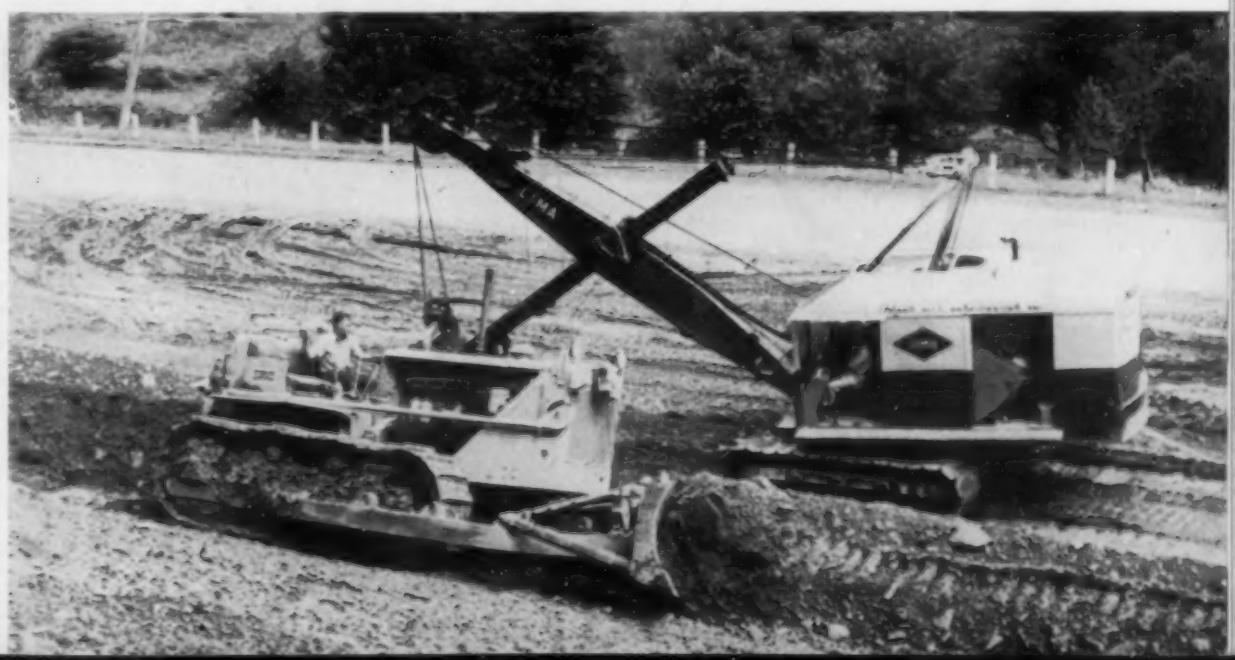
OUT OF 14,000 MILES of New York State highways, less than 1,000 miles are 3-lane and only 427 miles are 4-lane construction. About 89 percent of the system consists of two-lane roads when the demand is for four and six lanes. These facts are given in a recent report prepared by State Superintendent of Public Roads, Charles H. Sells, for New York State's Governor, Thomas E. Dewey. The report, which the Governor termed "the most important document issued by a state department in years," states further that the $840,000,000 estimate made two years ago, for a postwar highway rehabilitation program, is now outdated and inadequate and that a sum of $2,000,000,000 will have to be spent over the next 14 years to make the New York highway system efficient and safe.

New York State's proposed 486-mile throughway, for which work under the first contract, covering a section near Rochester, began in the latter part of 1946, is now off to a good start. The present estimated cost of the highway—said to be a year and a half behind schedule because of high costs and shortages of materials and equipment—is something over $200,000,000. Bids are now being asked for a 2.82-mile section on U.S. 96 (between Fishers and Victor) in the same area where half the grading of a $1\frac{1}{2}$-mile stretch and a cloverleaf on a 4-mile contract of nearly $2,000,000 is almost complete.

FIG. 1. MODERN THROUGHWAY, covering distance of 486 miles in New York State, passes near major urban centers. In 30-mile zone, each side, throughway can serve 50 percent of state's area and can be used by 90 percent of population.

From the New Jersey State line, at the tip of Rockland County, N.Y., the new multiple-lane highway runs north to Albany and proceeds almost due west to Buffalo where it takes a southwest course along Lake Erie shoreline to the western border of Chautauqua County, there joining the Pennsylvania highway system (Fig. 1). Direct passage through main towns and cities is avoided by providing arterial connections with all bypassed urban centers. New Jersey has coordinated plans for the southern terminus of the throughway in providing a high-capacity connection to the George Washington Bridge leading into New York City.

Malls of varying widths will separate opposing arteries of the throughway which has a 200-ft minimum right-of-way and a 3-percent maximum grade. Curves will have a minimum radius of 2,800 ft, allowing a distance vision of 1,000 ft, with shrubbery placed at all important points to absorb light glare. Traffic lights and grade intersections will be eliminated, all crossings being effected by overpasses or underpasses with cloverleaf connections.



AVERAGE of $143,000,000 must be spent annually until 1960 in New York State to create efficient network of highways that can handle expected registration increase from present total of 2,700,000 to 400,000,000. Pictured here bulldozer and shovel finish slope for cut on Route 17 between Wellsville and Bolivar, N.Y.

Continuous-Flow, Self-Cleaning Diversion Works Increase Water Supply of Colorado Steel Plant

FACED WITH THE NECESSITY of increasing its water supply to meet demands for increased steel production, without increasing the amount of water decreed for withdrawal from the Arkansas River, the Minnequa Plant of the Colorado Fuel and Iron Corp., Pueblo, Colo., replaced its conventional-type diversion works with a continuous-flow, self-cleaning structure. The following papers by Alfred J. Ryan and R. L. Parshall describe: (1) The modern diversion works that eliminate interruptions and thus increase the usable water supply, and (2) the sand trap, developed by Mr. Parshall, consisting of riffle deflectors and vortex tubes that permit continuous-flow operation.

Modern Control Works Solve Diversion Problems

ALFRED J. RYAN, M. ASCE
Crocker & Ryan, Denver, Colo.

RESTRICTED BY WATER rights which specify the quantity of water that can be withdrawn continuously from the Arkansas River, when available, and hampered by heavy stream loads of silt, sand, gravel and slush—plus miscellaneous refuse from canning factories, sawmills and ore mills—the Colorado Fuel & Iron Corp. faced the problem during the war of increasing its water supply for expanded operation at its Minnequa Plant at Pueblo, Colo. The expanded plant resulted in a water demand in excess of the amount that could be supplied if the existing diversion works were out of operation for any appreciable length of time. These works, similar to those used for irrigation ditches, necessitated frequent interruption of diversion for cleaning and repairing.

Interruptions of diversion are undesirable for two reasons: First, because adequate storage space must be provided to offset the interruptions; second, because of the problem of available water supply which is ever present in these Western areas where the right to withdraw water from streams is established by various state authorities. A direct water right consists of the right to withdraw a certain quantity of water continuously whenever the water under the specific decree is available in the river. If a diversion works is not in operation when water is available under the decree, the result is an absolute loss of that water—in most cases a direct financial loss.

The most feasible solution to the problem of obtaining additional water at the Minnequa Plant was to build a structure that would provide a diversion which was, for all practical purposes, continuous. To meet this condition, the diversion works had to be one that would be self-cleaning. It was also necessary that the diverted water be of a quality that would allow continuous flow in the channel, that is, free from sand and gravel and carrying a minimum of suspended silt in order to prevent clogging of inverted siphons and other canal sections having conditions of changing flow. The water also had to be clear of slush ice to prevent ice jams in the canal. The usual precautions regarding the exclusion of flood debris and other large floating objects also had to be observed.

IN ITS UPPER REGIONS the Arkansas River is a rough-and-tumble stream. Originating in the Rocky Mountains, it flows down a steep and rocky watershed. Since the rocky soil has little absorptive capacity and the vegetation is relatively sparse, the runoff is high and rapid, and the river and its tributaries have carved out deep and crooked channels. As a result of the carving process, which is continually going on, the river has a high percentage of silt, sand, and gravel. During flood stages, the river carries not only trees and other debris, but also moves boulders of considerable size. While no actual measurement has been made, observations of sand-bank formation and other phenomena indicate the movement of hundreds of tons of sand and gravel in a single day under flood conditions.

New Diversion Works Constructed

The diversion works developed to meet these conditions is shown in Fig. 1. The dam is basically a concrete structure supporting a series of gates, four of them 30 ft long by 7 ft high, and one 4 ft long by 7 ft high. Gates designed for both underflow and overflow are flanked by an overflow section, 16 ft long, on the opposite side of the river from the canal intake. This intake includes gates and trash racks at its upstream end, a dual sand trap and a measuring flume. The design was based on two methods of operation to meet the requirements of stream conditions.

The first method is used for all periods when slush ice is not flowing. It is based upon passing all of the water, except that which is diverted, under the gates. Automatic control of the river gates keeps them raised to the necessary height to allow this passage of water and at the same time to maintain a constant elevation of the upstream pool. The gates of the canal intake are raised completely out of the water to allow free-flow conditions with resulting low velocity at the entrance to the sand trap. The amount of water diverted is controlled by maintaining the pool level at the elevation required to produce the required flow in the canal.

Under this method the heavy bed load of the stream is continuously carried under the river gates and away from the diversion works. The sill of the canal intake is 3 ft above the

sill of the river gates so that the bed load will be carried past the intake without entering the canal. Floating debris is kept out of the canal by means of trash racks and is washed from the pool by opening one of the gates above the level of the pool. The automatic control lowers the other gates and maintains a constant pool elevation during this operation. By these devices the water entering the canal intake is relatively free of heavy bed load and floating debris. The remaining sand and a large percentage of the suspended silt are removed in the sand trap, which is described by Mr. Ralph L. Parshall in the article that follows.

Operation During Slush Ice Periods

The second method of operation is used during periods when slush ice is flowing. For this condition, the river gates are lowered to a depth that will force a portion of the water to flow over the overflow section, from which the stop-logs have been removed. The gates of the canal intake are lowered to a position at least 12 in. below the pool surface. The entire surface along the diversion side of the pool becomes still water. This soon fills with a layer of slush ice which freezes solid and forms an excellent skimmer. The water flowing over the overflow section maintains a surface velocity in the open portion of the pool and carries all additional slush ice out of the pool with it. The diverted water enters the canal at a higher velocity than under the first method, but this is not important since the amount of sand and silt carried by the stream is at a minimum during the winter months, when this method of operation is being used.

Except under extreme conditions, flushing of the bed load can be accomplished by maintaining some flow under the gates, and automatic control of the pool elevation can also be accomplished. At extremely low flow conditions it may not be possible to maintain flow under the gates, but at such times the bed load is very small. Such flushing as is required can be accomplished by raising one gate at a time for a short period. During conditions of extreme cold the automatic operation of the gates is sometimes impaired by freezing, but occasional movement of the gates minimizes this trouble.

The dam was designed to divert a flow varying from zero to 250 cfs of water from a river which flows with an average annual variation of 250 to 2,000 cfs. At the time the dam was built the maximum recorded flow was 11,820 cfs. A design flood of 30,000 cfs was used. This was used in view of the assumption that flow in excess of this amount would be diverted into other channels by upstream obstructions.

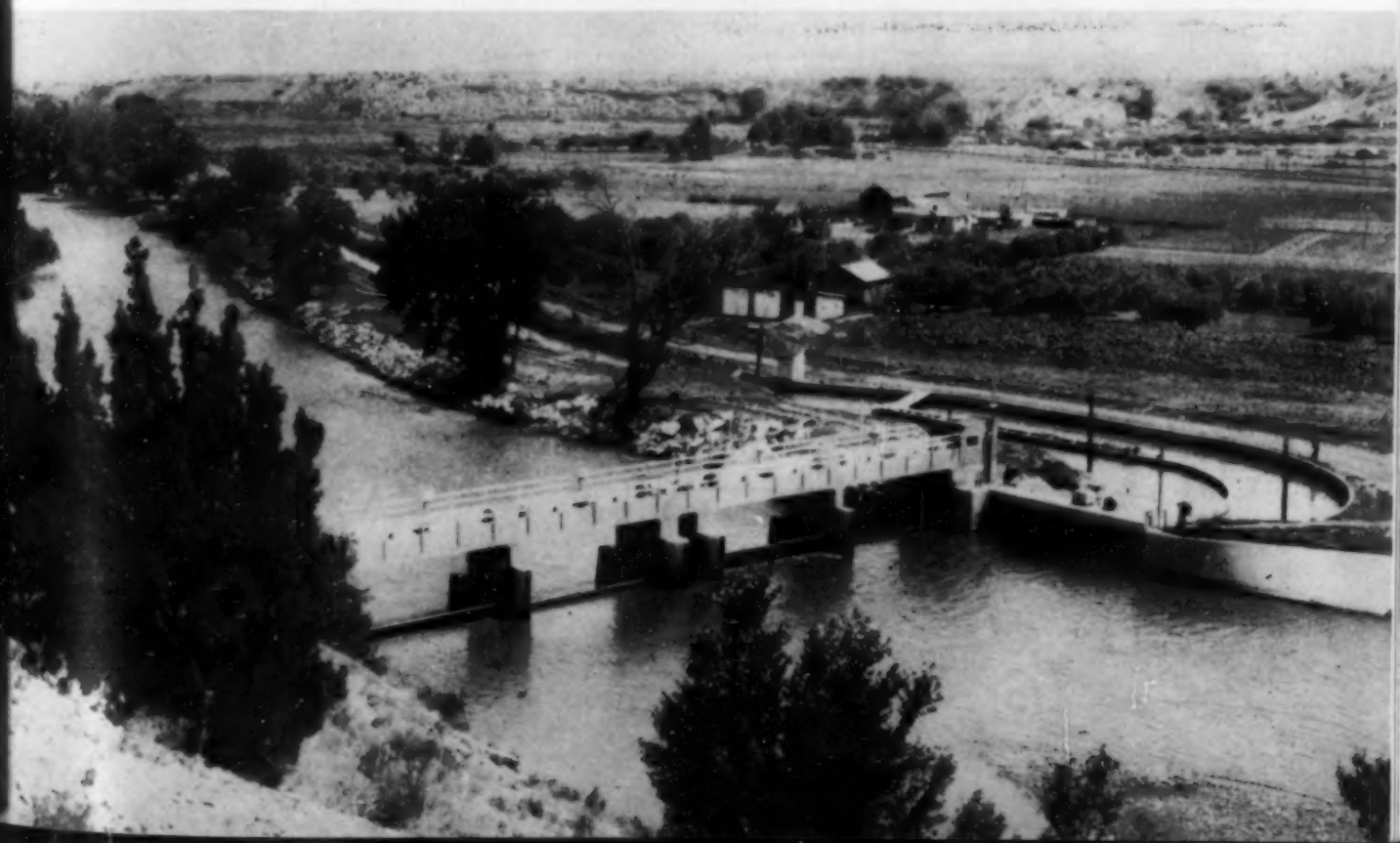
When the gates are raised to their highest position, 35,000 cfs can pass beneath them. As an added precaution the dam was designed to withstand the pressure of water flowing to a height of 10 ft above deck. If such a condition occurred, the handrail would be lost and the operation works would be drowned out, but the structure itself would remain. Since a flood of sufficient intensity to pass over the deck would inundate the adjoining valley for a width of one mile, further precautions seemed unnecessary.

Gate Section of Dam

In the gate area the sill is placed at a point 3 ft below the bottom of the diversion canal. Accelerated flow through the gate section is established by a 5-ft drop into the downstream stilling pool. The crest of the section in the overflow area is located 1 ft above the bottom of the diversion canal and allows the water to drop 9 ft into the stilling pool. Stop-logs are provided to prevent passage of water over this section during periods when slush ice is not flowing. The substructure is embedded 2 ft in sound sandstone.

A 12-in. reinforced concrete mat extends about 18 ft upstream from the dam. This mat provides a permanent bottom for the reservoir, facilitates the movement of bed load, and prevents scour. A 12-in. reinforced cutoff wall is carried to bedrock at the upstream end of this mat. A similar mat forms the bottom of the stilling pool extending 28 ft 6 in. downstream

CONTINUOUS OVERFLOW self-cleaning structure on Arkansas River replaces conventional-type diversion works to meet increased demand for water at Minnequa Plant of Colorado Fuel & Iron Corp., Pueblo, Colo. Upstream view of dam shows sand trap in background.



from the dam. This mat has a cutoff wall extending to bedrock at its downstream end.

The superstructure of the dam is of reinforced concrete construction and includes two retaining walls, five piers, an operating deck, and a small house for the auxiliary electric generator. The north retaining wall is poured against the disintegrating face of the sandstone cliff to maintain a constant section for the river channel. In addition to supporting the earthfill which forms the south side of the river channel, the south retaining wall also supports one gate reaction, the generator house, the stairs to the operating deck, a portion of the deck, and the inlet for the water supply for the gate control system. The piers not only support the gates and operating deck, but also house the float wells for the automatic gate-control system. All of the gate-control mechanism, as well as the equipment for the installation of stop-logs, is carried on the operating deck.

The general design of the gates for the dam is shown in Fig. 2. This type of radial gate has several advantages over the conventional type of Tainter gate when considered on the basis of the length used on this dam. It also has the distinct advantage of providing good facilities for both underflow and overflow. Under normal operating conditions, water will not overflow these gates, but provision for overflow is made to permit removal of floating debris.

It is anticipated that the concrete overflow section is ample for the passage of ice during most abnormal winters. However, to insure adequate passageway under the most severe conditions, the north gate is constructed with a removable top. When the top is removed it is possible to use this gate as an auxiliary overflow section. When the gate is in a closed position, the crest of the skin plate of its lower section is at the same elevation as the crest of the concrete overflow section. For normal conditions the removable section is bolted to the lower section of the gate to provide the same shape as that of the other gates.

A hollow-cylinder rubber seal bearing against the steel sill and side plates seals the gates, both at the bottom and on the sides. Raising of the 30-ft gates is accomplished by electric motor-driven gear-hoisting mechanisms operating through shafts, drums and cables attached to each end of the gates. The motors of these hoisting mechanisms are reversible and power for their operation is supplied through mercury - controlled, automatic electric switches equipped with auxiliary manually controlled switches. The weight of the gates is sufficient to allow them to be lowered by merely releasing tension on the lifting cables.

Control of the elevation of the water in the pool is accomplished by

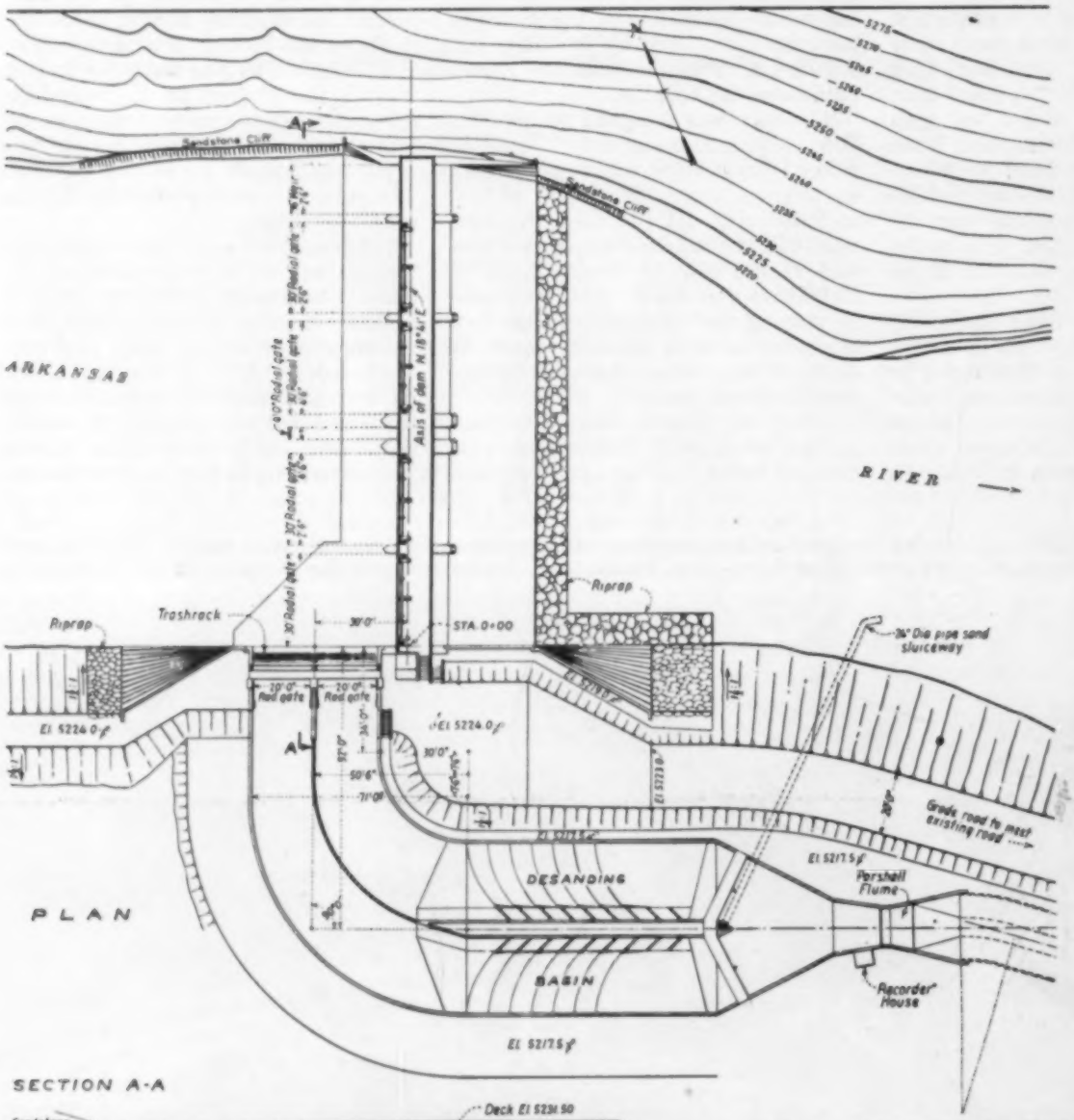


FIG. 1. PLAN VIEW AND SECTION through dam show details of concrete structure that supports series of five gates. Overflow section, 16 ft long, is on opposite side of river from canal intake. Undesirable 90-deg turn in channels between intake gates and sand trap is dictated by right-of-way conditions.

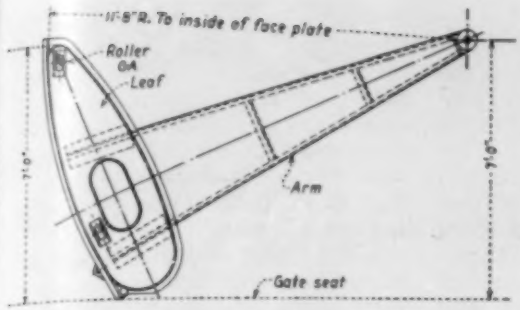


FIG. 2. GATE DESIGN (left) provides minimum maintenance and good operating conditions for both underflow and overflow. Overflow provision permits removal of floating debris.

placing the crest of the adjustable weir at the intake in a position which will permit the passage of a flow equal to the discharge of the downstream orifice. Any rise in the water surface caused by an increased river flow causes an increase in the flow over the weir, which in turn raises the water level in the float wells.

The rising float causes the mercury-controlled equipment to actuate the motor and raise the gates. The gates continue to rise until the increase in the river flow is passed below the gates and the water level in the pool becomes stable at the desired elevation. A decrease in river flow tends to lower the elevation of the pool, thus decreasing the flow over the weir. By a reversal of the process, the gates are lowered and the pool elevation is stabilized at the desired level.

The gates can be raised and lowered by the operators at any time by manually-controlled electric switches which are auxiliary to the automatic switches. Power for gate operation is taken from a supply line furnished for that purpose. Because of the possibility that power may be interrupted during flood conditions, an auxiliary diesel-driven power generator is provided in a small house at the south end of the dam where it is protected from flood waters and can be easily reached by the operators. Power failure, as well as rising of water in the pool above the desired elevation, is made known to the operators by a battery-operated alarm system.

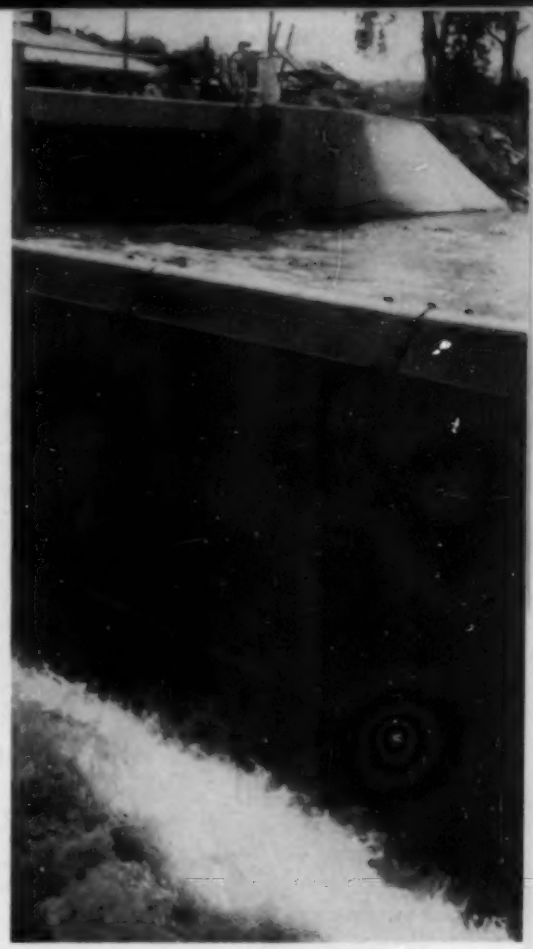
At the time the dam was designed, the actual precision with which the automatic gate-control equipment would operate was indeterminate. Efficient operation requires that the variation in pool elevation be not more than 1 in. As there was some doubt that the automatic control of the 30-ft gates would afford such precision a 7-ft gate was also provided which can be raised and lowered in much the same way as the large gates, except that the power is supplied by adaptation of the regular counterweight and float-control method.

The cone-type weir for control of this gate is set manually for the desired pool elevation, the water supply being obtained through the same system that supplies water for the automatic control equipment for the larger gates. Since the mechanism attached to the small gate is adaptable to minor variations in river flow and is not easily affected by wave action, it allows the pool elevation to be controlled with considerably less than 1-in. variation.

AUTOMATIC CONTROL regulates river gates to pass all water, except that which is diverted, under gates. Maintaining of pool level at elevation desired produces required flow in canal. Pictured here are operating deck and gate-control mechanism.

Two Channels Form Canal Intake

The canal intake, which is in the south bank of the pool directly upstream from the dam, is of a conventional design except that two independent channels are provided to allow greater flexibility of operation.



CANAL INTAKE SILL (in background of photo) is 3 ft above sill of river gates (foreground) so that bed load will be carried past intake without entering canal.

In order that the diverted water may be free of the heavy bed-load passing through the dam, the intake sill is placed 3 ft higher than the sill of the dam. The trash racks consist of panels of $3^1/_2 \times {}^3/_8$-in. bars placed 6 in. on centers. The two 20-ft by 5-ft 6-in. radial gates are of the conventional type with a steel face plate supported on horizontal girders. The controls consist of one 5,000-lb, manually-operated hoist for each gate. Since normal operations require infrequent movement of these gates, it was not considered necessary to provide power controls.

Right-of-way conditions necessitated an undesirable 90-deg turn in the channels between the intake gates and the sand trap, but the use of an average radius of 50 ft 6 in. provides flow characteristics through this turn which are not sufficiently different from those in a straight channel to materially affect the operation of the sand trap. After passing through the sand trap, described in the following paper, the diverted water is measured through a standard Parshall measuring flume, which has a 12-ft throat and is equipped with a continuous recording measuring device. It operates without being submerged and discharges directly into

the canal. The measuring flume is downstream from the sand trap, and thus the water used in the operation of the sand trap is returned to the river prior to measurement of the diverted water.

The results obtained in the operation of these diversion works have been exceptionally good. Since the works were placed in operation on June 27, 1943, required interruption of diversion due to difficulties and to maintenance of the structure has occurred for a total of only 9 days; such a record was heretofore considered almost impossible. The value of the water diverted through this structure, which would have been lost by the use of a conventional-type diversion structure, has far exceeded the figure used in setting up the economic justification for the additional cost of construction.

The operation of the automatic control mechanism for the large river gates has been even more satisfactory than was first contemplated. It was originally believed that, because of minor stream-flow variations and wave action, it would be impracticable to try to control the pool elevation within 1 in. by means of the automatic control mechanism used in conjunction with the large gates, but actual operation has shown that by the use of this mechanism the pool elevation can be controlled within less than $^1/_2$-in. variation. In fact, this type of automatic control, even when applied to large gates, has proved more satisfactory than the float and counterweight type applied to the small gate.

Since these diversion works were placed in operation it has been necessary to make two changes, one of which was the lengthening of the outfall line of the sand trap, as described in Mr. Parshall's paper; the other was in the details of the 30×7-ft gates to prevent chattering.

Riffle Deflectors and Vortex Tubes Remove Suspended Silt and Sand

R. L. PARSHALL, M. ASCE

Senior Irrigation Engineer, Soil Conservation Service, Fort Collins, Colo.

IN DESIGNING the diversion works described by Mr. Ryan in the preceding article, a sand trap consisting of riffle deflectors and vortex tubes was decided on as the means of trapping the bed load entering from the Arkansas River into the heading of the Minnequa-Union Canal which serves as a supply for the Colorado Fuel and Iron Corporation's steel works at Pueblo. This canal has a capacity of 250 cfs and a length of about 54 miles.

Sand traps of various types have been designed and tested in the hydraulic laboratories at Fort Collins, Colo., by the Irrigation Division of the Soil Conservation Service in cooperation with the Colorado Agricultural Experiment Station. The different types of devices were developed with the intention of covering the range of field conditions as to hydraulic characteristics and the nature of the material to be removed. The various combinations of width of channel, depth of water, velocity of flow and amount and nature of sand to be trapped precludes the use of any one design to meet all requirements. None of the devices so far developed is capable of capturing and removing suspended material.

The riffle-deflector and vortex-tube type of sand trap was chosen for installation at the heading of the Minnequa-Union Canal because the combination of riffles and vortex tubes results in a very efficient means of dealing with the heavy bed-load common to nearly all canal diversions from the Arkansas River. Also, such an arrangement of riffles and tubes permits successful operation for a moderate canal velocity.

Sand Trap for Narrow Channels

For a relatively narrow channel 8 to 12 ft wide, having velocities ranging from 4 to approximately 7 fps, with discharges from 25 to 300 cfs, the vortex-tube sand trap has been perfected to eliminate the bed load of sand and moderate-size gravel. Because of the velocity of flow it is assumed that the elevation of the lip of the tube can be so placed as to provide near-critical flow over the tube, a condition necessary for optimum vortical action and maximum transportation of material with this device.

The vortex tube is merely a tube of slight taper, 1 to 50, from the outlet end, open at the top side with edge, or lip, parallel to the axis and laid across the width of the channel at an angle of approximately 45 deg. The slope of the tube toward the outlet should be about 1 to 50.

For channels of greater width, moderate velocities in the order of 2.5 to 4 fps, and capacity of flow ranging from 50 to more than 500 cfs, the riffle-deflector type of trap has been developed. In general plan the structure is a rectangular flume, of either wood or reinforced concrete, and of suitable width and length. The floor slopes transversely 1 to 15 with the side opposite the outlets at grade of channel. On this sloping surface are placed the curved deflectors, which in plan are parabolic.

Approximately, $y = 0.025D^{1.9}$ for a structure 16 ft wide. In this equation, y is the offset from a line normal to the axis of the structure and D the distance from the side wall. The riffle has a vertical upstream face of 12 to 18 in. and the top side, 3 to 6 ft wide, slopes to zero depth at the downstream edge. Five to ten such riffles placed adjacent to each other constitute a set, the number used depending upon the nature of the bed load. For relatively coarse material, fewer riffles would be required. The ends of the riffles are in a line 2.5 to 4 ft from the wall of the structure, on the outlet side.

At the end of the first riffle, upstream side, is placed a short vortex tube, set at 45 deg, the top side of which is at the floor line. Additional tubes are placed at the upstream end of each riffle following downstream. If the bed load is fine sand in considerable quantity, each riffle should be provided with a vortex tube. For heavy sand and gravel, fewer riffles may be used and tubes added at every other riffle. These several tubes discharge into a compartment at the side of the structure and the total accumulation of sand is led away through a common outlet.

The sand trap or desilting works for Colorado Fuel and Iron Corporation's diversion works consists of two channels in each of which are placed nine concrete riffle deflectors with an equal number of short vortex tubes with outlets discharging into a longitudinal compartment common to

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SAND TRAP for removing bed load entering heading of Minnequa–Union Canal from Arkansas River consists of riffle deflectors and vortex tubes which permit successful operation for moderate canal velocity.

both channels. The length of riffle, side wall to inner end of the vortex tube, is 21 ft, and the distance from the end of the riffle to the side wall of the compartment is 4 ft. The height of riffle, upstream face, is 16 in. and the width or base is 7 ft, as measured parallel to the axis of the structure. The base of the riffle at the outer wall is at the grade of the canal; at the other end it is about 18 in. lower.

Riffles are parabolic in plan and laid out by offsets from a line normal to the side wall according to the approximate equation $y = 0.028D^{1.93} + 0.44$, where y is the offset and D the distance out from the wall (both units in feet). The curve of the riffle was determined from experimental riffles used in model tests in the laboratory, which proved to be quite satisfactory. The vortex tubes are cast of concrete to a diameter of about 8 in. and a length of about 6 ft, and set at 45 deg to the channel axis. The compartment has an inside width of 4 ft, 8-in. side walls, and a floor that slopes toward the downstream or outlet end with a drop of 4 to 6 in. in 75 ft.

The effluent from the compartment is carried back to the river channel through a 24-in. concrete pipe. This discharge line originally reached out to nearly the middle of the river channel at a point about 200 ft downstream from the diversion dam. At the outlet end of this pipe was placed a 60-deg ell pointed downstream, which was intended to increase the draft through the pipe. Nothing is known as to whether much was accomplished by this special fitting.

Sand Disposed of on River Bank

It was fully expected that by proper sluicing through the 30-ft radial gate openings in the dam the river bed between the dam and the end of the outlet would be scoured out and a greater difference in the effective head between the water surface in the compartment of the sand trap and that of the river would be realized. Because of the excessive amounts of heavy gravel moving in the river, the sluicing operations caused the filling-in of the bed of the channel, reducing the velocity in the outlet and eventually covering the end of the pipe. A part of this line was then abandoned and an extension of about 300 ft of 24-in. pipe was laid parallel to the river channel and outletted on the bank of the stream. About 200 ft of this new line has an adverse grade of 1 percent; however, it has proved effective in carrying away the sand and gravel accumulated in the compartment of the sand trap.

At the outlet end of this new line is a tide gate, which during brief periods of extreme high stage of the river caused by flash floods, is closed to prevent backwater from moving into the compartment of the sand trap and to prevent material from being carried into the pipe which might under certain conditions clog the line.

At first the outlets of the several vortex tubes were at full opening. Later a simple slide gate, placed vertically on the wall inside the compartment, was provided for each tube. Experience in the operation of the sand trap indicates that better results are obtained by throttling down the tube discharge.

No quantitative tests of the efficiency of this large sand trap have been made. It is probable that special apparatus will be necessary to examine this matter effectively because of the nature of the problem

(*Continued on page 94*)

FLUSHING OF BED LOAD is accomplished by maintaining small flow under dam gates. Under low-flow conditions required flushing is accomplished by raising one gate at a time for short periods. Downstream view of dam shows gate mounting.

New Standard Covers Lightweight Floor Construction

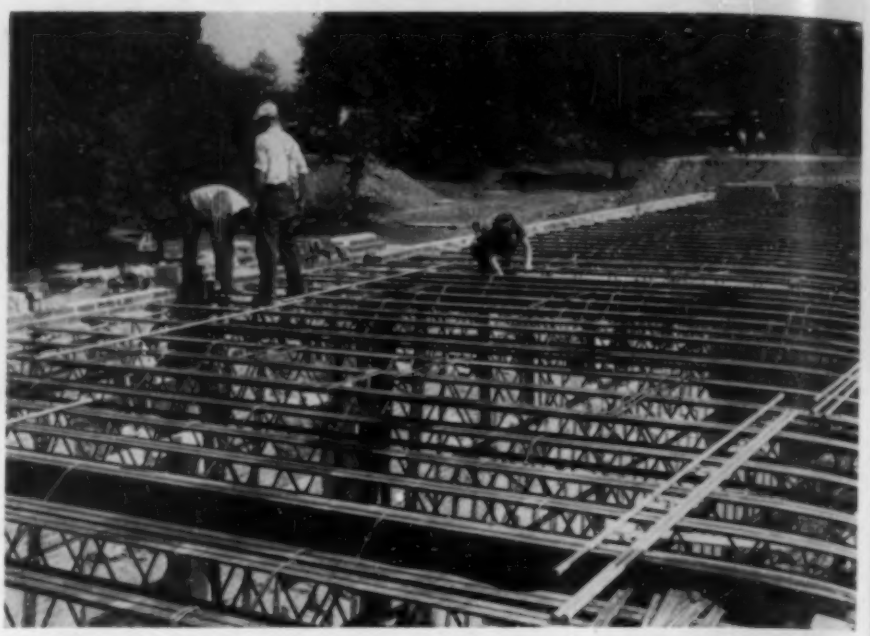
RECENTLY APPROVED by the American Standards Association, the new *American Standard Building Code Requirements for Steel Joist Construction, A87.1-1947*, provides economies in lightweight fire-resistive floors, ceilings and roofs that in turn permit savings in the cost of structural building frames and foundations.

The standard, developed by an ASA committee sponsored by the American Iron and Steel Institute and the American Society of Civil Engineers, is intended for use by municipal and state building officials as a means of increasing uniformity in building code requirements.

According to S. H. Burgess, managing director, Steel Joist Institute, in a recent issue of the ASA publication *Industrial Standardization*, "Approval of a standard on lightweight flooring is particularly significant at this time as it recognizes a type of construction which lends itself especially well for use in the fire-resistive types of building construction. It is quickly and easily erected; and its use makes it possible for fire-resistive buildings to be constructed without the owner having to assume the burden of paying for construction materials which are not actually incorporated into a building. The steel joists themselves act as a support for the metal lath form which is used as reinforcement for the top concrete slab, and ceiling lath may be applied directly to their bottom chords, thus eliminating the necessity for furring channels."

Mr. Burgess states further, "Tests have demonstrated that floor and roof construction composed of steel joists, a 2-in. concrete floor slab, and a metal lath and plaster ceiling ($^3/_4$-in. gypsum or portland cement plaster) attached directly to the under side of steel joists will safely withstand $1^1/_2$-hour fire test exposure as prescribed in the American Standard Fire Tests of Building Construction and Material, A2.1-1942.

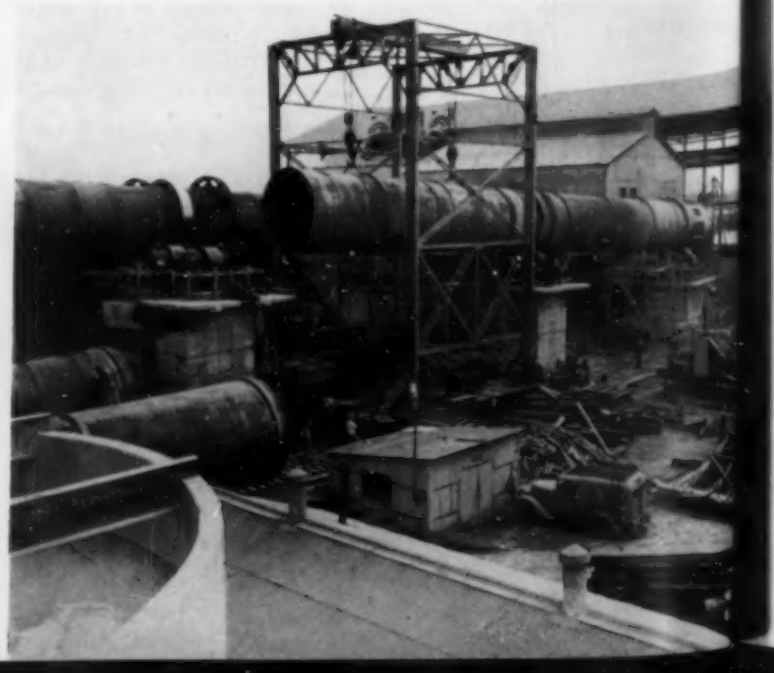
"In buildings used for certain types of occupancies where the fire risk is higher, a greater fire-resistive rating than $1^1/_2$ hours is required. Tests by the National Bureau of Standards have demonstrated that such ratings can be assigned to steel joist construction when protected with slightly thicker concrete slabs on top of the joists and with gypsum or gypsum-vermiculite plaster ceilings of appropriate thickness below. The various fire-resistive ratings of steel joist construction can be found in *Building Materials and Structures Report BMS-92*, of the National Bureau of Standards. Ratings also will be incorporated in the forthcoming American Standard Building Code Requirements for Fire Protection and Fire Resistance which is still under preparation by the committee."



OPEN STEEL JOISTS in lightweight fire resistive building construction are covered by new ASA standard as means of increasing uniformity in building code requirements. Many million square feet of lightweight floors and roofs are being installed annually. Light joist floors pictured here are for State Teachers' College building, Stroudsburg, Pa. (Photograph courtesy "Industrial Standardization.")

Gantry Crane Expedites Erection of Rotary Kiln

SPECIALLY BUILT 33-TON GANTRY CRANE, with 30-ft span and 55-ft vertical clearance, hoists sections of oil-fired rotary kiln, 12 ft in diameter, into place on reinforced concrete foundation piers at General Portland Cement Company's plant in Tampa, Fla. Gantry, designed and fabricated by The Austin Co., engineers and builders in charge of job, is mounted on standard-gage tracks laid along outer sides of piers. Temporary bents made from pile cutoffs and braced with 4×8's (right foreground) facilitate permanent bolting of kiln sections. Layout includes reinforced concrete burner building 40×64 ft, 60 ft high, designed to take lifts up to 25 tons in servicing and maintenance of equipment; also kiln drive building, 44×68 ft, 66 ft high; and 20-ft slurry tank.



Civil Engineers

Share Knowledge of Fluid Mechanics With Many Related Professions

HUNTER ROUSE, M. ASCE

Director, Iowa Institute of Hydraulic Research, State University of Iowa, Iowa City, Iowa

DURING THE FIRST quarter of the present century, technological advancements made ever greater demands upon existing principles of fluid motion. As one profession after another sought to apply these principles in new fields of endeavor, it soon became apparent that the simplified bulk-flow relationships of the nineteenth century could not satisfy the need for detailed knowledge of the internal flow mechanism. The present-day science of fluid mechanics gradually evolved to meet these demands, fortunately without restriction to any one professional field.

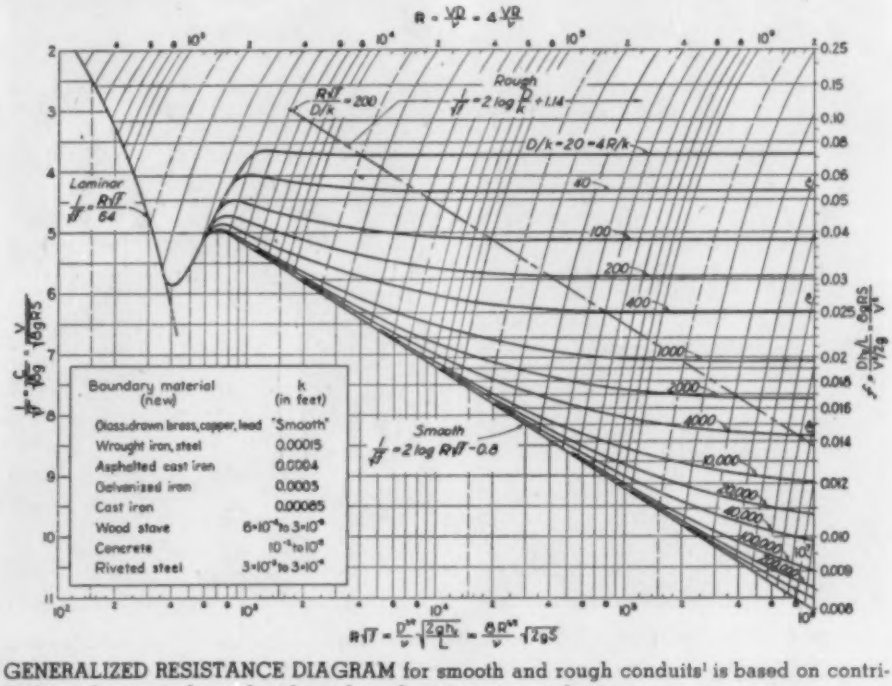
Many proponents of the new science eventually began to claim that it would—or at least should—replace the older science of hydraulics, which at once gave rise to the counter claim that the two sciences actually differed only in name. It remained for the exigencies of the recent war to prove conclusively that hydraulics and fluid mechanics are neither identical nor incompatible. And that each has much to give the other was evidenced near the close of the war by the creation of a Committee on Fluid Mechanics within the Hydraulics Division of the Society. What, then, are the true roles of these sciences in the engineering world, and what in particular does fluid mechanics have to offer the civil engineer?

THE COMMITTEE on Fluid Mechanics of the Hydraulics Division of the Society has compiled a list of motion pictures of fluid flow phenomena which would be useful in teaching and for other educational purposes. These pictures cover a wide range of subjects, ranging from the conventional model study to study of basic phenomena such as turbulence, diffusion in fluids and raindrop erosion. The motion pictures can be borrowed from their owners, and in some cases purchased. In general, there is a small rental fee to cover expenses. The list of motion pictures, along with information on where they may be obtained and the rental fees, may be secured from Vito A. Vanoni, Hydrodynamics Laboratory, California Institute of Technology, Pasadena 4, Calif.

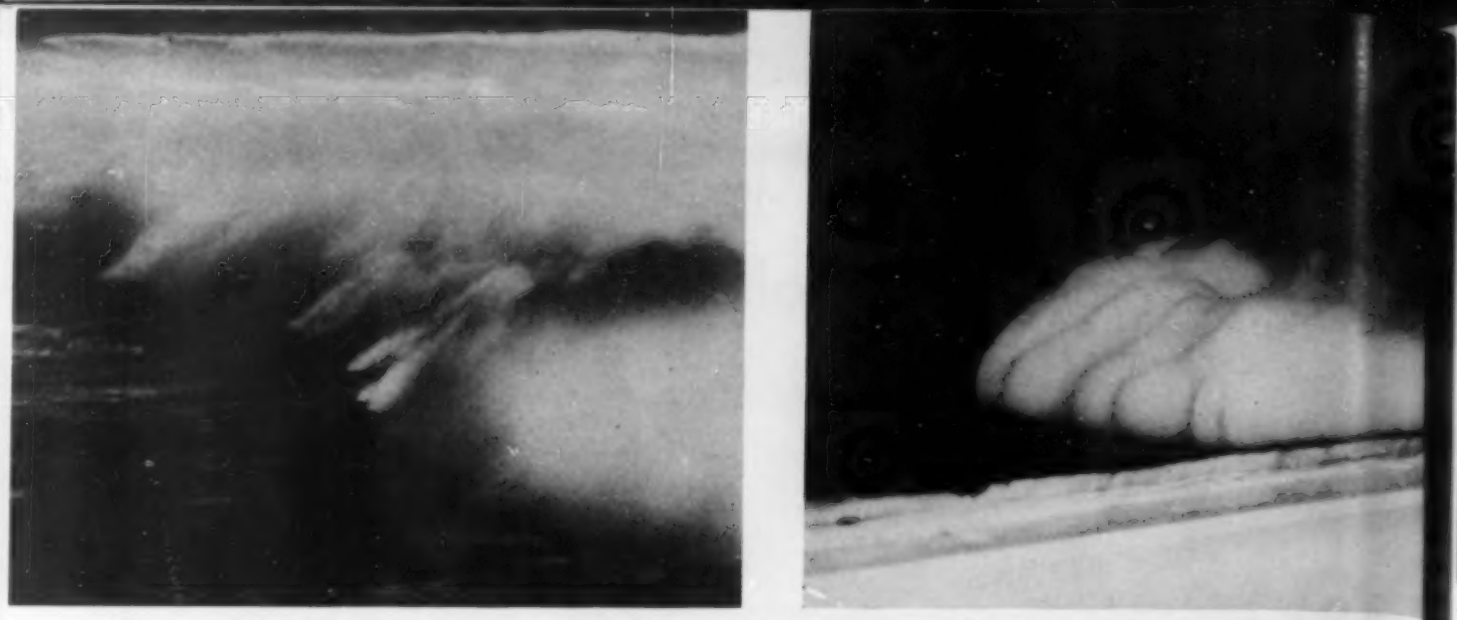
Pool of Fundamental Information

As the writer has stressed in many a lecture, the science of fluid mechanics has come to represent a pool of fundamental information on fluid motion in general and in detail, which is contributed to and utilized by a great number of different professions. The list of these professions is seemingly endless, but it includes primarily aeronautical, chemical, civil, marine, and mechanical engineering, as well as geology, meteorology, oceanography, and physics. In no sense of the word can such information be considered pure hydraulics any more than pure aeronautics—or even physics itself. On the contrary, fluid mechanics is a generally applicable rather than a restrictively applied science, and modern hydraulics represents its application to a specific engineering field. In a word, the science of fluid mechanics has a much broader basis than hydraulics, whereas hydraulics extends far beyond fluid mechanics in a particular field of application.

Formation of a small Committee on Fluid Mechanics within a large Division of Hydraulics in no way controverts the foregoing distinction, but merely gives official recognition to a relationship which already existed between the Society and the various other professions sharing in the same basic information pool. In the heat of controversy, sight has often been lost of ways in which the civil engineer has already contributed to and profited by this common store of fluid knowledge. A timely



GENERALIZED RESISTANCE DIAGRAM for smooth and rough conduits[1] is based on contributions of many independent branches of engineering and science.



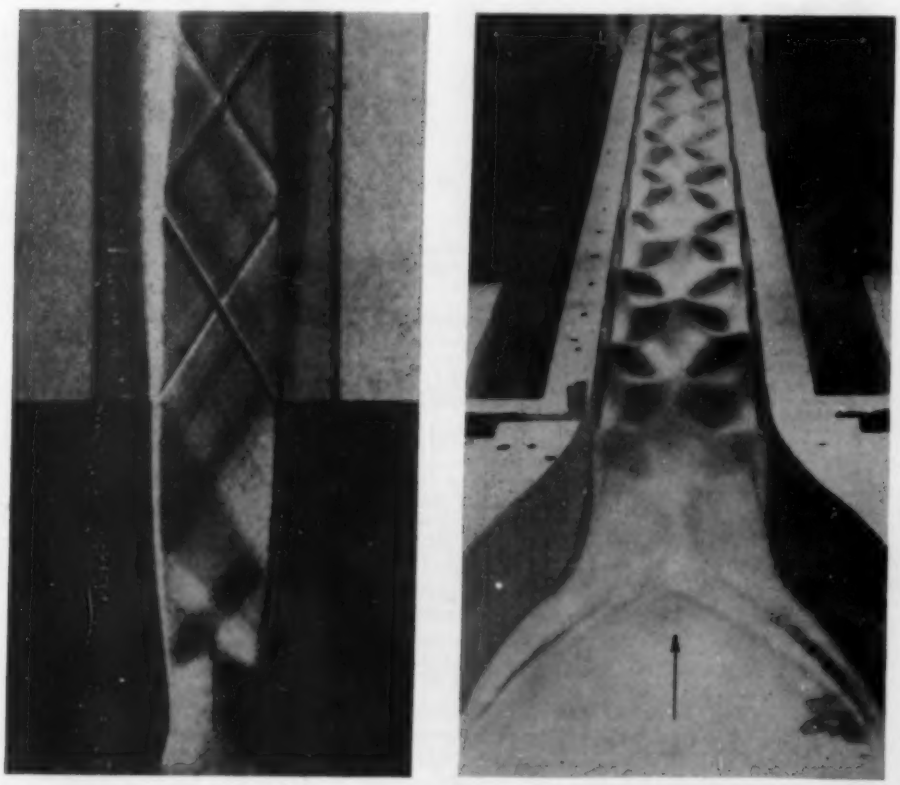
GRAVITY CURRENTS follow same fundamental laws in both air and water, regardless of scale. Pictured above (left) is dust storm several thousand feet thick[2] and (right) sediment-laden underflow in model reservoir.[3]

case in point is the matter of flow-induced vibration of immersed bodies —whether they be telephone wires, submarine periscopes, airplane members, or suspension bridges. The wealth of basic information now at hand includes much that has been supplied by the civil engineer; there remains much more that he might well utilize to his—and the public's —profit.

Perhaps the most familiar example of the advantage to be gained by the pooling of knowledge from various fields is found in the problem of pipe resistance. Civil engineers of this country have to their credit much of the experimental data on head loss in smooth and rough conduits both large and small. Without combining therewith the analytical discoveries of physicists, aerodynamicists, and engineers of many countries, however, the generalized resistance diagram now in use would never have been produced. On the other hand, had the practice of pooling information existed at the turn of the century, recent advancements might well have occurred many years earlier.

Sources of Illustrative Material

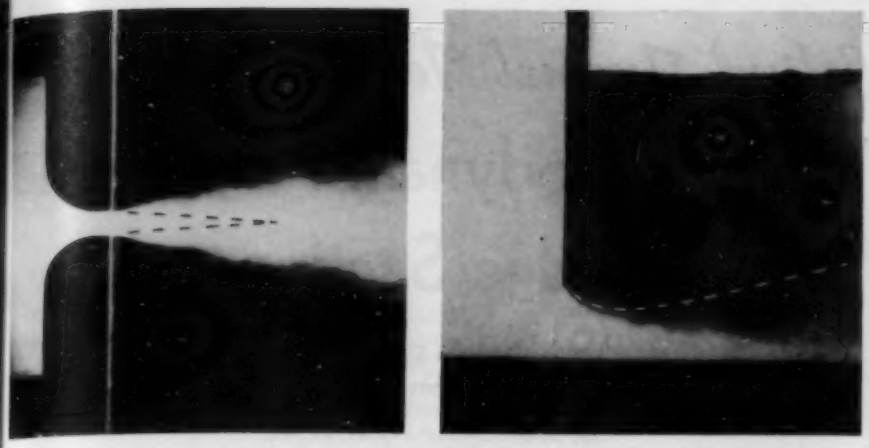
[1] "Elementary Mechanics of Fluids," by Hunter Rouse, Wiley, 1946, p. 211.
[2] Photograph by C. E. Recknagel, United Air Lines.
[3] Photograph by H. S. Bell, Soil Conservation Service, California Institute of Technology.
[4] "Handbuch der Experimentalphysik," Vol. IV, Part 1, Wien-Harms, 1931, p. 429.
[5] Photograph by A. T. Ippen, Lehigh University.
[6] Photographs by F. W. Kent, Iowa Institute of Hydraulic Research, State University of Iowa.
(See references in captions to illustrations.)



CONTROL OF WAVE FORMATION in supercritical flow is important in hydraulics as well as in aeronautics. Pictured at left, above, are patterns formed by sound waves in air[4] and at right are similar patterns formed by gravity waves in water.[5]

Much was heard prior to the war of the so-called "density" currents—the underflow of slightly heavier silt-laden water through clear-water reservoirs. Such gravity currents actually differ little from the clouds that moved over the dust bowl in years not long past, from the thermal currents in the ocean, or from the cold fronts that are analyzed daily by weather forecasters. In fact, the laboratory simulation by meteorologists of atmospheric gravity currents through use of saline solutions in hydraulic flumes is a significant indication of a common goal. Such experiments were first made by civil engineers; the fact that the final solution of the problem still remains to be found is sufficient grounds for pooling efforts.

The analogy between the surface-wave resistance of ships, the sound-wave resistance of projectiles, and the wave formations in high-velocity chutes and flood-relief channels has been recognized for more than a decade. In fact, sound-wave analysis has aided greatly in providing effective principles of design for open-channel transitions subject to supercritical flow. Requirements of the recent war finally brought the use of this analogy full circle, and now most supersonic tunnels employ supple-



TURBULENT DIFFUSION of submerged jets[6] plays a basic role in ventilation, energy dissipation, and propulsion—not to mention the mere act of breathing. In view above, at left, air is discharged from slot (smoke shows outer limit and dotted lines inner limit, of mixing zone); at right, water is discharged from sluice gate (dye shows inner limit, and dotted line outer limit, of mixing zone).

mentary towing tanks for rapid exploratory studies of sound-wave patterns simulated at the water surface by the movement of various body forms. Electrical analogs for fluid motion of various other types have proved equally helpful, as witness the simulation of potential flow, water hammer, and complex pipe networks entirely by means of electrical circuits.

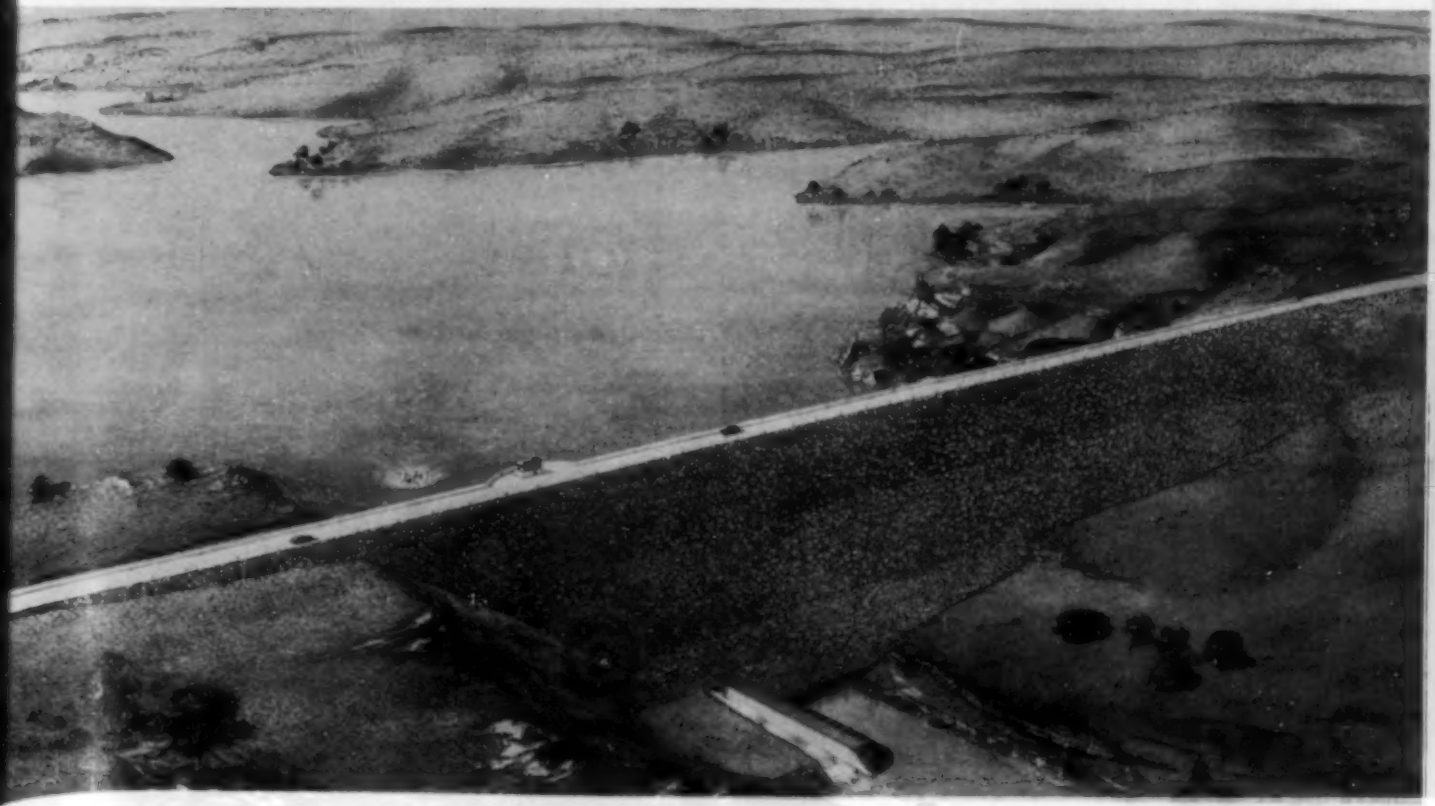
That phase of fluid mechanics which unites the various professions most securely in their quest for knowledge continues to be the phenomenon of fluid turbulence. An understanding of turbulence is coming to be as essential to the civil engineer as to the aeronautical—in matters of diffusion as well as boundary resistance. Unfortunately for the hydraulician (though very fortunately for the interchange of knowledge between related fields), the measurement of turbulence is far simpler in air than in water, and this is one of the reasons for the appearance of air tunnels in various hydraulics laboratories. To carry the relationship to a specific case of vital interest to civil engineers, it may be noted that the transfer of sediment particles between the bed of a river and the turbulent stream above is not greatly different from the transfer of water molecules between the free surface of a river and the turbulent atmosphere above. Whether hydraulic or chemical engineers (or physicists or hydrologists) will first complete the gap in present analyses of the transport of foreign matter by a turbulent fluid remains to be seen. Surely joint endeavor, without delay in the interchange of experience, will be many times as effective as the independence which has so often retarded general scientific progress in past years.

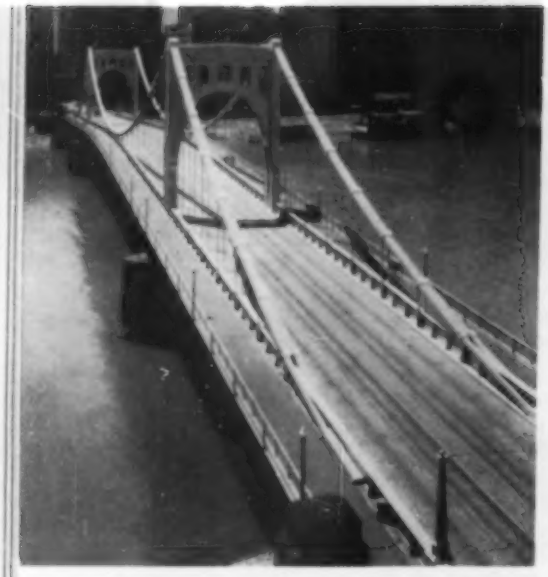
How the Committee on Fluid Mechanics plans to be of aid to civil engineers and to related professions in promoting mutual aid and understanding is embodied for the present in the following activities: (1) It

(*Continued on page 94*)

Earthfill Dam Is Unit in Missouri Basin Project

HEART BUTTE DAM, located on Heart River about 18 miles south of Glen Ullin, N.Dak., is irrigation and flood control unit in huge Missouri Basin project. Embankment requiring approximately 1,129,000 cu yd of earth and rock fill will have crest length of 1,850 ft and will rise about 125 ft above river bed. Combination spillway, with glory-hole intake and outlet works, will be constructed on right abutment of dam. Bids for dam were opened recently at Bureau of Reclamation office at Bismarck, N.Dak.





AERODYNAMIC INSTABILITY in long-span structures may be reduced, and in some cases entirely eliminated, through use of proper combinations of slots (openings in bridge floor) and fins (lateral projections). Sidewalks on Seventh Street Bridge, Pittsburgh, Pa., pictured here, illustrate practical application of outside fins.

Wind Tunnel Tests Yield Aerodynamically Stable Bridge Sections

Tests Provide Data on Effects of Slots and Fins on Stability

D. B. STEINMAN, M. ASCE
Consulting Engineer, New York, N.Y.

RECOGNIZING THAT the ideal, scientific solution of the problem of aerodynamic instability is to find bridge sections that eliminate this dangerous potential characteristic, a systematic test program has been undertaken to discover and verify the forms and proportions of sections yielding assured aerodynamic stability. By simple wind-tunnel tests, following the investigation and classification of a wide range of basic sections, the separate effects of open-grid floors, lateral slots, central slots, and outside fins, and of various combinations of these features, have been plotted and studied. As a result of this planned exploration, a number of practical cross sections have already been found offering, within the applicable range, *complete aerodynamic stability*, vertical, torsional, and coupled, for all angles of incidence and all amplitudes, at all wind velocities. This article is presented as a report on the search to date for such optimum sections of complete aerodynamic stability against both limited and catastrophic oscillations. The present installment relates to half-through sections ("H-sections") with solid-web girders, leaving other forms, including truss-type sections, to subsequent reports. The same basic principles will apply.

HISTORY HAS SHOWN that the greatest danger to long-span bridges lies in their vulnerability to aerodynamic forces. Recent disasters have shocked engineers into a realization of the serious importance of the problem. As the conclusion of an article on "Design of Bridges Against Wind —IV. Aerodynamic Instability—Prevention and Cure," in CIVIL ENGINEERING for January 1946, the writer stated:

"By various means that have been indicated, resistance to the effects of aerodynamic instability may be built up to any desired amount. These methods resist or check the effects, but do not eliminate the cause.

"By scientific design of the cross section, the cause of aerodynamic instability can be very materially reduced, and with some sections entirely eliminated. The one line of attack places the emphasis on providing increased resistance to a dangerous inherent characteristic; the other aims to avoid or eliminate the dangerous characteristic—aerodynamic instability of the cross section.

"It is more scientific to eliminate the cause than to build up the structure to resist the effect."

The Test Problem

In line with the foregoing statement of guiding principles and convictions, the writer has undertaken a systematic exploration of the aerodynamic properties of various forms and proportions of bridge cross sections and of various indicated modifications of such sections. To this end, he has secured the generous cooperation of Prof. F. J. Maher, Jun. ASCE, utilizing the wind-tunnel facilities of the Virginia Polytechnic Institute. With the help of a grant from the Research Corp., the test program has been extended and amplified.

The procedure thus far has been limited to wind-tunnel tests on small section models, yielding the basic information in the form of static lift

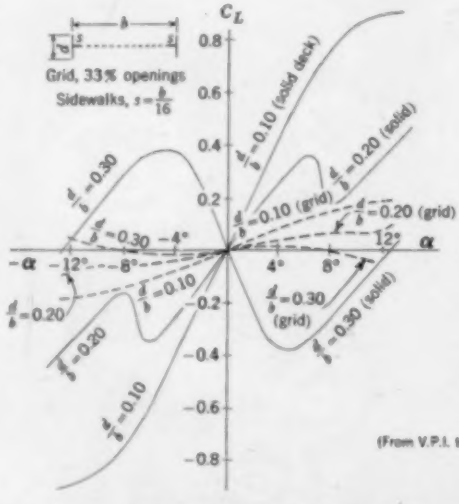


Fig. 1 (*a*). OPEN-GRID ROADWAY eliminates vertical instability. Static lift curves for girder H-sections with open-grid roadway.

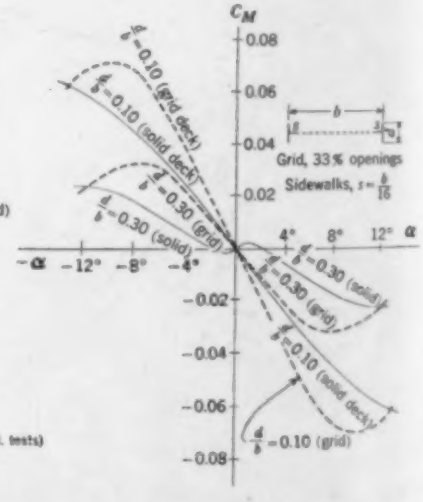


FIG. 1 (*b*). OPEN-GRID ROADWAY intensifies torsional instability. Static torque curves for girder H-sections with open-grid roadway.

and torque graphs. Oscillating model tests will follow, for confirmation and amplification of the findings yielded by the static tests. Some of the findings have been anticipated or confirmed by simple oscillating model tests made (and publicly demonstrated) by the writer since 1940.

The writer's basic thesis that the aerodynamic characteristics of a section may be determined by static wind-tunnel tests has already received ample confirmation. To the writer's knowledge, no observed data or experimental results contradicting that thesis have thus far been found.

Interpretation of Static Lift and Torque Curves

The static lift and torque graphs of a section reveal the governing aerodynamic characteristics with respect to vertical and torsional instability, respectively.

A *negative* slope of the graph in the range considered identifies a section having potential *catastrophic instability*. The steeper the slope, the greater the instability.

A *positive* slope of the graph in the range considered identifies a section having no potential catastrophic instability.

In both cases, positive or negative slope, the section may have *limited instability* in the lower ranges of wind velocity ratios, as distinguished from the higher catastophic range. (Ten existing bridges, in this country and abroad, are known to have manifested oscillations representing such limited instability.)

The section of the original Tacoma Narrows Bridge had positive slope of lift graph and negative slope of torque graph. The former explains the vertical oscillations of limited amplitude during the four-months' life of the structure, and the latter explains the catastrophic torsional oscillations that destroyed the bridge.

An ideal section aerodynamically would be one having lift and torque graphs of zero slope, i.e., each following a horizontal line as closely as possible over the range considered. Horizontality of *both* graphs in the applicable range represents the complete elimination of all aerodynamic forces that may cause instability.

Unmodified Sections

No unmodified section, whether girder or truss type, is entirely satisfactory aerodynamically.

Girder-type sections are classified by their d/b ratios, where d is the girder depth and b is the section width. (Truss-type sections may be similarly classified by their equivalent d/b ratios.)

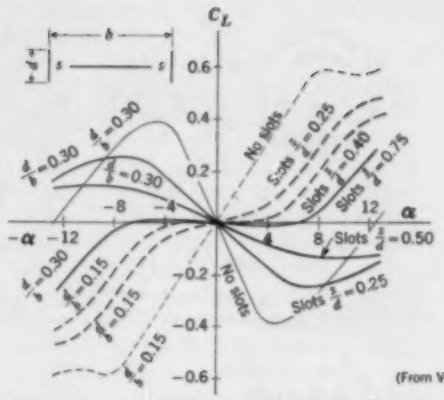


FIG. 2 (*a*). LATERAL SLOTS eliminate vertical instability. Static lift curves for girder H-sections with lateral slots.

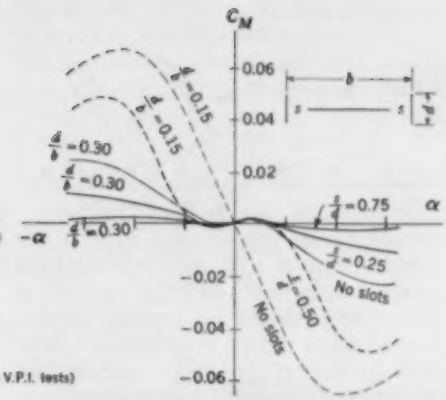


FIG. 2 (*b*). LATERAL SLOTS reduce torsional instability. Static torque curves for girder H-sections with lateral slots.

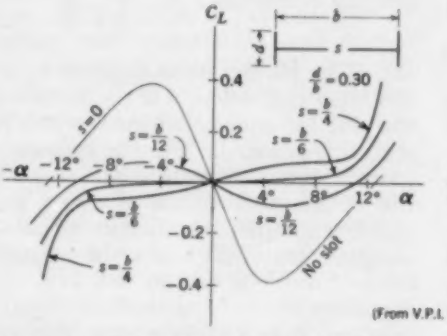


FIG. 3 (*a*). CENTER SLOT eliminates vertical instability. Static lift curves for girder H-sections with center slots.

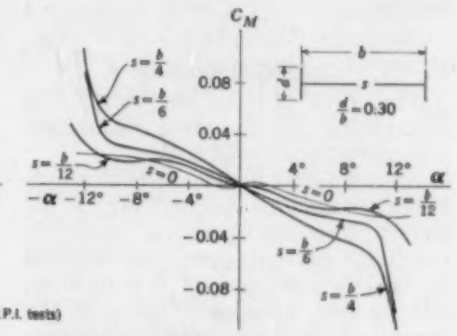


FIG. 3 (*b*). CENTER SLOT increases torsional instability. Static torque curves for girder H-sections with center slots.

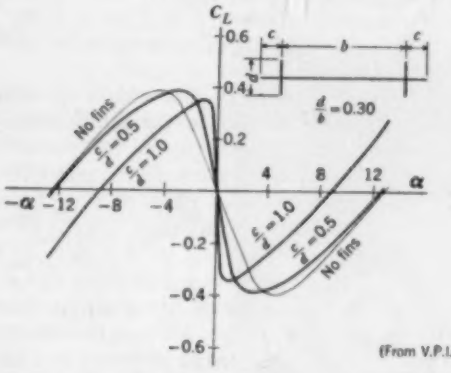


FIG. 4 (*a*). OUTSIDE FINS do not aid vertical stability. Static lift curves for girder H-sections with outside fins.

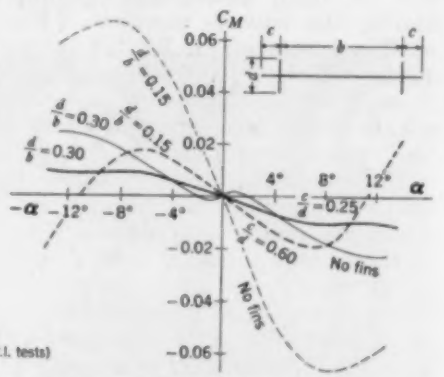


FIG. 4 (*b*). OUTSIDE FINS reduce torsional instability. Static torque curves for girder H-sections with outside fins.

All sections deeper than $d/b = 0.07$ have negative slope of *torque graph*, representing catastrophic *torsional* instability.

All sections deeper than $d/b = 0.25$ have negative slope of *lift graph*, representing catastrophic *vertical* instability.

All sections (except flat plates) have *limited* vertical and torsional instability in the low velocity range.

Flat plates (and equivalent sections) have potential catastrophic instability in *coupled* vertical and torsional oscillations. Moreover, on account of reversal of slope of the lift and torque graphs beyond the central range of positive slope, such sections become vertically or torsionally *unstable* when certain minimum angles of incidence or certain minimum amplitudes are exceeded.

(NOTE: The abscissas of the lift and torque graphs are angles of incidence. Amplitudes, both vertical and angular, are convertible into equivalent ranges of angles of incidence.)

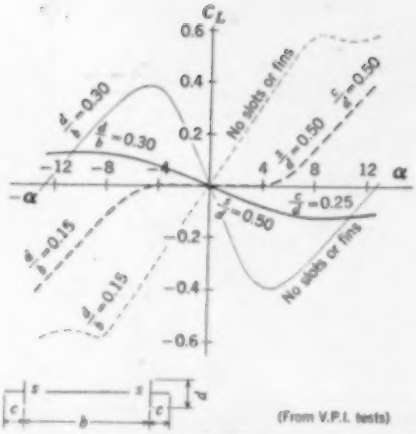


FIG. 5 (*a*). LATERAL SLOTS and outside fins cure vertical instability. Static lift curves for girder H-sections with side slots and fins.

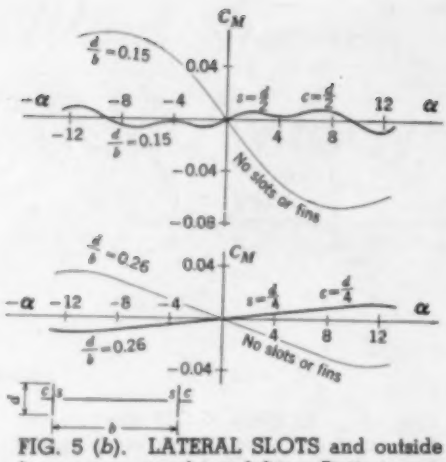


FIG. 5 (*b*). LATERAL SLOTS and outside fins cure torsional instability. Static torque curves for girder H-sections with lateral slots and outside fins.

Open-Grid Roadway

The first obvious suggestion for eliminating aerodynamic instability is to use an open-grid deck.

An open-grid floor reduces or eliminates *vertical* instability. Fig. 1 (*a*) shows how an open-grid roadway (with 33 percent openings) applied to various sections (d/b = 0.10, 0.20, 0.30) greatly reduces or levels off the slopes of the lift graphs, whether those slopes are positive (representing limited instability) or negative (representing catastrophic instability). For d/b = 0.30, catastrophically unstable, the cure is complete. For shallower sections of limited instability (d/b = 0.10 and 0.20), the cure is only 80 percent complete, indicating that a more open grid would be required for optimum results.

Unfortunately, however, an open-grid roadway does not eliminate *torsional* instability. On the contrary, in most cases, torsional instability is intensified, as shown in Fig. 1 (*b*). For d/b = 0.10 and 0.30, the catastrophic negative slope is augmented 60 to 80 percent. Moreover, the small initial hump of positive slope in the torque curve for d/b = 0.30 represents a minimum amplitude that must be exceeded before instability commences; whereas, with the open-grid floor, catastrophic instability commences at zero amplitude and at zero angle of incidence.

An apparent exception (not shown in Fig. 1(*b*)) is for sections around d/b = 0.20, for which a slight reduction (12 percent) of catastrophic torsional instability by the use of an open-grid roadway is indicated.

Lateral Slots in Roadway

Lateral slots in the roadway effectively reduce or eliminate vertical instability. This is shown by Fig. 2 (*a*). The effectiveness depends upon the ratio s/d, where s is the width of the slot (or equivalent open width if a grating is used). For the catastrophically unstable section d/b = 0.30, the optimum slot ratio is $s = {}^3/_4\, d$, yielding complete elimination of catastrophic instability over a central range from −7 deg to +7 deg. A slot ratio of $s = {}^1/_2\, d$ yields an 80 percent cure over a wider range. For the section d/b = 0.15 (of limited instability), the optimum slot ratio is s = 0.40d, yielding a 100 percent cure of the limited instability over a central range from −4 deg to +4 deg, with diminishing effectiveness beyond that range.

Lateral slots in the roadway also reduce or eliminate *torsional* instability (Fig. 2*b*). For the section d/b = 0.15 (with very strong catastrophic instability), a slot ratio of $s = {}^1/_2\, d$ yields a 100 percent cure over a central range from −3 to +3 deg, but has little value beyond that range; however, the hump introduced in the central range represents a minimum amplitude that must be exceeded before instability commences. For the section d/b = 0.30 (also catastrophically unstable), a slot ratio of s/d = ${}^3/_4$ yields practically a 100 % cure.

For the section d/b = 0.38, the test curves (not shown) indicate that lateral slots with a ratio s/d = 0.50 would yield practically a 100 percent cure of both vertical and torsional instability.

Center Slot in Roadway

A center slot in the roadway improves *vertical* stability (Fig. 3*a*). For the section d/b = 0.30, a slot ratio of $s = b/6$ completely eliminates catastrophic instability; it also eliminates limited instability over a central range from −8 to +8 deg.

Unfortunately, however, a center slot in the roadway *increases torsional instability* (Fig. 3*b*). For the section d/b = 0.30, a slot ratio of $s = b/12$ doubles the torsional instability and eliminates the minimum amplitude required. With a slot ratio of $s = b/6$, the instability becomes steeply catastrophic at ±11 deg of incidence or equivalent amplitude. Curvature of an unstable lift or torque graph away from the horizontal axis (or toward the vertical axis) over an extended range represents an especially dangerous condition, namely, catastrophic instability without a limiting amplitude.

Outside Fins

Outside fins do not materially aid *vertical* stability. For the unstable section d/b = 0.30, as shown in Fig. 4 (*a*), outside fins actually intensify catastrophic vertical instability. For the limited instability section d/b = 0.15 (not shown here), outside fins are slightly helpful.

On the other hand, outside fins materially improve *torsional* stability (Fig. 4*b*). For the section d/b = 0.15, which is catastrophically unstable, a fin ratio of c = 0.60d yields a 50 percent cure, and a higher fin ratio

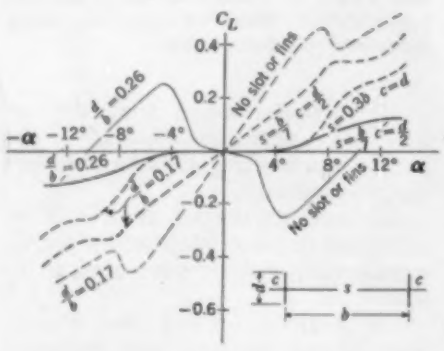


FIG. 6 (*a*). CENTER SLOTS and outside fins cure vertical instability. Static lift curves for girder H-sections with center slot and outside fins.

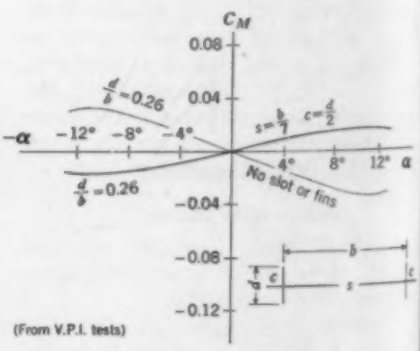


FIG. 6 (*b*). CENTER SLOTS and outside fins cure torsional instability. Static torque curves for girder H-section with center slot and outside fins.

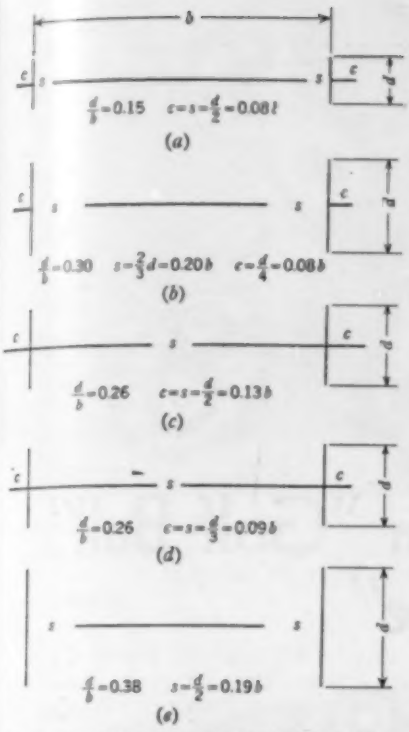


FIG. 7. AERODYNAMICALLY stable bridge sections.

of $c/d = 1.0$ would yield a 100 percent elimination of catastrophic instability. For the section $d/b = 0.30$, the optimum fin ratio is $c/d = 0.25$ to 0.30, yielding a substantial elimination of catastrophic instability. In general, apparently, the optimum fin width is 0.08 or 0.09 of the section width b. Such fins may take the form of cantilever brackets utilized for sidewalks or other utilities.

Recent tests on a truss H-section showed that the addition of outside fins raised the critical angle of incidence (for catastrophic oscillations) from 6 deg to a safer value of 15 deg.

It is interesting to note in this connection that no bridge with outside brackets or cantilever sidewalks has ever been known to show aerodynamic instability.

Combination of Lateral Slots and Outside Fins

Since lateral or central slots eliminate vertical instability and outside fins materially reduce or eliminate torsional instability, the next logical step in the test program was to try various combinations of slots and fins in order to find proportions yielding possible simultaneous elimination of both types of instability. This thought has yielded gratifying results.

Combinations of lateral slots and outside fins in suitable proportions have been found to yield a cure of *both vertical and torsional instability*. Such combinations of slots and fins have been repeatedly suggested by the writer since 1941 in his published contributions.

Fig. 5 (*a*) shows the elimination of vertical instability. For the limited instability section $d/b = 0.15$, lateral slots of widths $s = {}^1/_2 d$ combined with outside fins of width $c = {}^1/_2 d$ yield a 100 percent cure over the range from -4 to $+4$ deg, together with a reduction of the limited instability beyond that range. For the catastrophically unstable section $d/b = 0.30$, lateral slots of width $s = {}^1/_2 d$ combined with outside fins of width $c = d/4$ yield a 75 percent cure, and somewhat wider slots and fins ($s/d = {}^2/_3$ and $c/d = {}^1/_3$) offer a 100 percent cure. Similar results are found for intermediate sections. For $d/b = 0.26$ (not shown in Fig. 5*a*), $s = c = d/2$ yields a 75 percent cure of catastrophic instability, and $s = c = {}^2/_3 d$ offers a 100 percent cure.

Figure 5 (*b*) shows the elimination of torsional instability. For the section $d/b = 0.15$ (torsionally catastrophic), the slot and fin combination $s = c = {}^1/_2 d$ yields a 100 percent cure over the complete working range. For the section $d/b = 0.26$, the slot and fin proportions $s = c = {}^1/_4 d$ overdo the cure, and somewhat reduced proportions $s = c = 0.20d$ offer an optimum combination. For the section $d/b = 0.30$ (not shown in Fig. 5*b*), the optimum proportions for torsional stability are $s/d = {}^1/_2$ and $c/d = {}^1/_4$, yielding a virtually complete cure over the applicable range.

Combination of Center Slot and Outside Fins

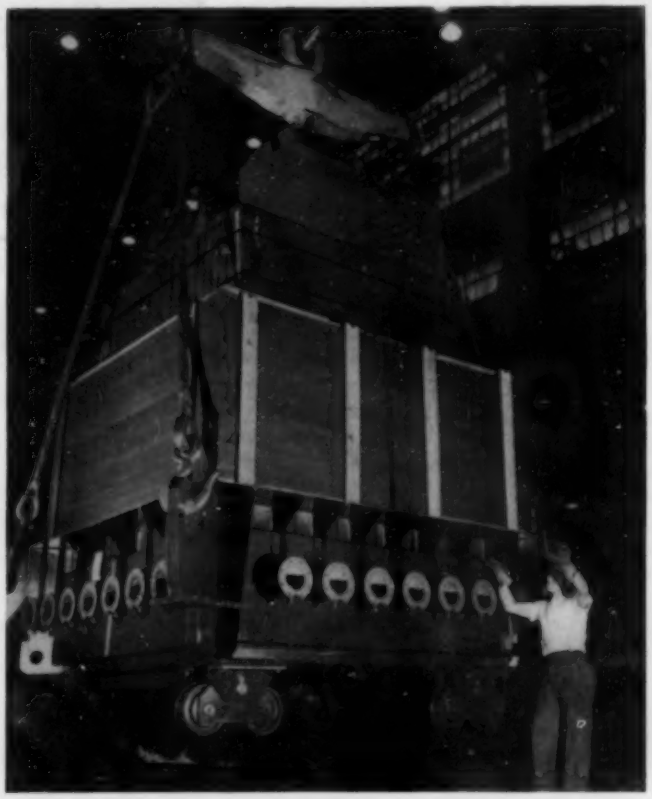
Sections with central slot and outside fins in suitable proportions offer a *complete elimination of aerodynamic instability*. This combination was first suggested by Daniel Frederick, who was engaged on the wind-tunnel tests as a graduate student in applied mechanics at the Virginia Polytechnic Institute.

The reduction or elimination of vertical instability is shown in Fig. 6 (*a*). For the section $d/b = 0.17$, a central slot $s = b/7$, combined with fins $c = {}^1/_2 d$, yields a 50 percent cure of the limited instability. Doubling the width of the slot and fins offers a 100 percent cure from -6 to $+6$ deg. For the catastrophically unstable section $d/b = 0.26$, a central slot and outside fins of the proportions $s = b/7$ and $c = {}^1/_2 d$ yield a 100 percent cure.

The complete elimination of catastrophic torsional instability for the

(*Continued on page 94*)

More Power for Puget Sound Area



LARGEST SINGLE-PHASE TRANSFORMER built by Westinghouse Co. is prepared at company's Sharon, Pa., plant for shipment to Bonneville Power Administration's new $2,700,000 Snohomish Substation near Everett, Wash. Transformer is rated at 50,000, 66,667, and 83,333 kva, according to use of self-cooled, air-cooled, or oil-cooled systems. Four such transformers to be installed at substation will operate at 230 kv. Three units will perform as bank with ratings of 150,000, 200,000, and 250,000 kva, depending on method of cooling used. Station increases power supply of area north of Seattle and between Puget Sound and summit of Cascades.

PLATES FOR FIRST SECTION of riser (above) are hoisted into place for arc welding to completed cone pedestal. Pedestal is bolted to 20-ft 1-in.-dia concrete plinth 24 in. thick. Cylindrical sections (right) are hoisted into place by derrick anchored to side of column. Power for hoist is furnished by gasoline engine.

Welded Steel, 40,000-Gallon "Golf Ball" Rests on 65-Ft "Tee"

MODERN DESIGN, unusual construction techniques and a clever paint job combine to create an engineering structure that pleasantly identifies the particular type of diversion for which the Tam O'Shanter Country Club near Chicago is noted. The structure, a 40,000-gal watersphere erected recently by the Chicago Bridge & Iron Co., points the way to minimizing incongruity between necessary engineering structures and their immediate environment.

The 22-ft 10-in.-dia welded steel "golf ball" is supported on a tubular column "tee" approximately 65 ft high, tapering in diameter from 5 ft 6 in. at the base to 4 ft 6 in. at the top. Inside the column are a 6-in. riser and an inside scaling ladder which serves as access to the water tank. The base of the column is a welded steel cone pedestal 5 ft 6 in. in diameter at the crown and 19 ft 9 in. at the base, which is bolted to a concrete ring plinth.

The shaped sections for the base cone and tank were welded together at the site by shielded carbon steel electrodes supplied with current from a gasoline-engine-driven 300-amp generator. Butt-weld V-joints were employed, using two beads for $^1/_4$-in. plates and three beads for heavier plates, one of the beads being a back-up weld placed on a peened surface. Back-up welds were used on all joints between plates.

ORANGE-PEEL SECTIONS are partially assembled on ground, hoisted into position above cone pedestal and welded to form 22-ft 10-in.-dia watersphere. Scaffolding consists of wood plank supported by metal braces welded to curved plates of sphere.

THREE-PLATE SECTION in upper half of sphere is positioned for welding by means of gasoline-engine-driven hoist in right foreground. All plates are joined by butt-welded V-joints made with shielded carbon steel electrodes.

COMPLETED SPHERE is raised 65 ft into position for welding to circular bearing plate on steel column. Total steel, including accessories such as anchor bolts and access ladder, amounts to nearly 20 tons.

FURBISHED AND DECORATED tank reaches height of 86 ft above grounds of Tam O'Shanter Country Club in Chicago. Two catwalks and entrance door to shaft are provided just below base of tank. Completion time for structure was about three weeks.

The plates of the upper cylindrical sections of the riser were welded on the ground and raised to position by a small derrick anchored to the top of the column. When all ten sections had been erected, the spherical tank was built about the base of the column, resting on the cone pedestal. It was then raised by use of pulleys into position for welding the base of the sphere to a circular bearing plate at the top of the seventh column section.

The thicknesses of steel plate used in construction of the watersphere are as follows: pedestal, $^{9}/_{32}$ to $^{13}/_{32}$ in.; column, $^{1}/_{2}$ in. at bottom to $^{7}/_{16}$ in. at top; sphere $^{5}/_{16}$ in. in lower half and $^{1}/_{4}$ in. in upper half. During the three weeks required for erecting the structure, construction progressed without mishap and there were no undue delays except on a few windy days when work was hazardous.

Soil-Cement Tested as Low-Cost Canal Lining

RESEARCH IN LOW-COST linings for irrigation laterals and studies in economy of construction through use of mechanical equipment were the objectives of a full-scale field test in the use of plastic soil-cement made recently by the Bureau of Reclamation in cooperation with the Portland Cement Association. For the test the Bureau selected a 4,400-ft lateral in the Altus reclamation project near Martha, Okla.

In a canal section consisting of a 4-ft bottom width and 5.41-ft sides on a $1^{1}/_{2}$ to 1 slope, a 3-in.-thick lining of plastic soil-cement was placed by special equipment. The cement content of the mix ranged from 11 to 22.2 percent and the moisture content from 25 to 30 percent. Soil excavated on the site was placed in a pugmill, watered and mixed to proper proportion and consistency and delivered by conveyor to the canal section.

Equipment provided by the Portland Cement Association consisted of a Barber-Greene traveling mixer and an Ekenstam canal paver adapted to this particular job. The job was completed in about five weeks under the direction of Wayne S. Byrne, Assoc. M. ASCE, Bureau of Reclamation, construction engineer in charge of work at Altus.

Maximum performance was the laying of 275 ft of soil-cement paving per hour, the greatest speed reached being 1,375 ft in 6 hours 10 min. Hand hoeing was used for moving the mix to the outside edges of the paver as no mechanical device was provided for this purpose. A more or less finished surface resulted, requiring little additional hand labor. A fast traveling form, specially designed for the paver, shaped the soil-cement to required line, grade, cross section and thickness. Tests showed that the specified plastic flowed readily into place and retained its shape and form on the steep slope of the canal side.

The Bureau of Reclamation is making further studies with a view to advancing this type of work to a regular contract basis. For a detailed account of the tests described here see the June 1947 issue of *Soil-Cement News*.

PLASTIC SOIL CEMENT LINING 3 in. thick is laid by mechanical equipment in 4,400-ft lateral of Altus irrigation project near Martha, Okla. Barber-Greene mixer prepares and deposits mix of excavated soil and cement by conveyor. Canal has 4-ft bottom and 5.41-ft sides on $1^{1}/_{2}$ to 1 slope. Only hand operation consists of spreading mix in Ekenstam paver by hand hoes. Finished surface—requiring little, if any, additional hand labor—has smooth, even texture and contour. White pigment is applied to prevent evaporation loss.

Engineers' Notebook

Simple Trusses Were First Analyzed Correctly Only One Hundred Years Ago

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Assoc. M. ASCE

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ANALYSIS OF STRESSES in a simple truss seems elementary today, when undergraduate courses in technical mechanics and even high school textbooks deal with the subject. However, it is only a century since the first correct and adequate treatment of truss analysis was made public.

In 1847 Squire Whipple, civil engineer of Utica, N.Y., made his notable contribution to structural analysis in a book entitled "A Work on Bridge Building, consisting of Two Essays, the one elementary and general, the other giving Original Plans and Practical Details for Iron and Wooden Bridges." ("Squire," incidentally, was Mr. Whipple's given name—not a title.)

Engineer Whipple, having applied successfully the principles of statics to truss analysis, next proceeded to devise the statically *indeterminate* type of truss that bears his name [Fig. 1 (*a*)]. In 1852 Mr. Whipple employed his truss system for the first time in the construction of an all-metal bridge of 145-ft span on the Rensselaer and Saratoga Railway, 7 miles north of Troy, N.Y. (Fig. 2). All the compression members of this bridge were of cast iron, while the tension members were of wrought iron. Pin connections were used freely.

The special feature characterizing the "Whipple truss" was the use, in the web system, of diagonals extending over two panels. The object, of course, was to provide short panel lengths (for an economical floor system), while maintaining a reasonably economical inclination of the web diagonals.

The truss actually provides two systems of web bracing, and may be thought of as a combination of two Pratt-type trusses [Figs. 1 (*b*) and Fig. 1 (*c*)] with common chords. In

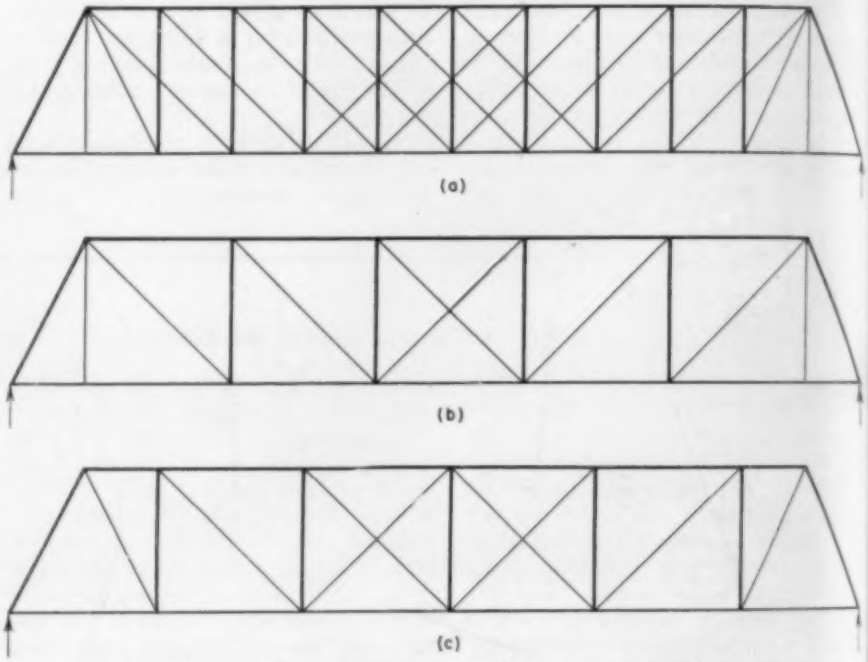


FIG. 1. WHIPPLE TRUSS (*a*) is described as "double intersection" Pratt truss because of web system employed (above). Truss may be regarded as combination of two Pratt-type trusses, (*b*) and (*c*), with common chords.

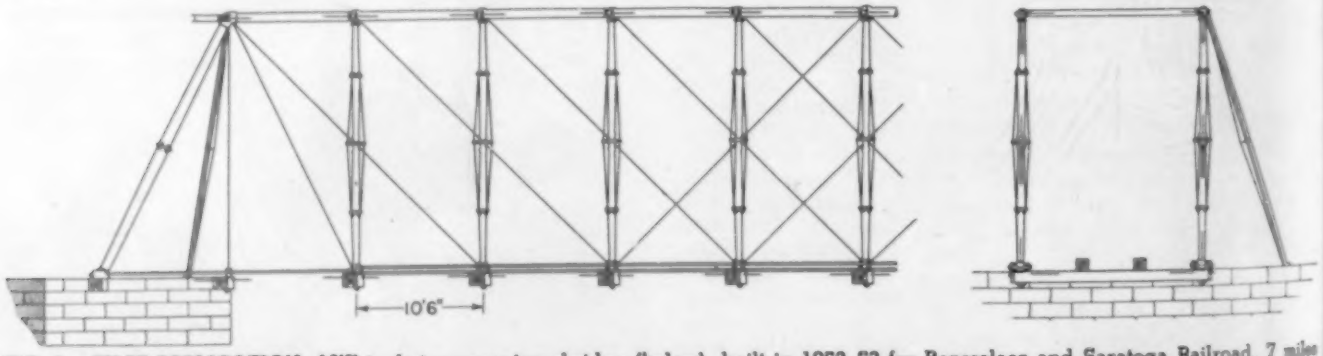


FIG. 2. FIRST APPLICATION of Whipple truss was iron bridge (below), built in 1852–53 for Rensselaer and Saratoga Railroad, 7 miles north of Troy, N.Y. Top chord and posts were of cast iron, with lower chord of wrought-iron links. Round web rods of wrought iron with eyes at upper end and screw ends below were connected to pin through top chords, passing through holes in cast-iron shoe at foot of posts. Shoe had oblong trunnions at each side to receive lower chord links. Although proportioned for rolling load of only 1 ton per lin ft, bridge continued in service until 1883.

stress analysis the two simple, component trusses were usually assumed free to act independently of each other, and the stresses determined on this assumption were combined to give the stresses in the actual truss. Treatment of the truss as a statically indeterminate problem was thus avoided at the expense of some loss in accuracy.

Although the Whipple truss is no longer built, it is noteworthy as a prototype of the modern steel truss bridge. Modern heavy load requirements are fast removing Whipple trusses from the contemporary scene but it is to be hoped that governing commissions will see fit to preserve at least a few examples of these structures, both for their intrinsic interest and as memorials to the distinguished American engineer who, just a century ago, first enunciated the true theory of truss action.

Personal Data File Saves Valuable Time

GEORGE O. GUESMER, Assoc. M. ASCE
Engineer, Corps of Engineers, Department of the Army, St. Paul, Minn.

MANY EXCELLENT SYSTEMS of filing have been devised such as the Dewey Decimal and the Library of Congress, but these methods all require more time and technical training than the average engineer wishes to devote to the routine but important job of putting away an article so that he can find it readily. At the office you can ask Evelyn for that clipping you gave her to file last August. However, if you clip an article with a good idea now and then as you read the technical journals, the idea generally ends up in your "pile file" and is hard to find when you want it. The following file system is simple, easy to use, and gets results. It is equally effective for filing clippings, pamphlets, photographs, letters and drawings.

A study of the various personal file systems made some years ago by the writer revealed a subject specialization that failed to fit the general field of civil engineering. Most schemes presented a general outline with the suggestion that each should select his own subjects. The selection of subjects is the difficult part of setting up any system. After reviewing text, handbook and technical magazine indices as well as the subject headings of the library filing systems, the writer made a selection of those subjects which appeared most suitable for a general file. The subjects as selected have proved to be adequate with a few additions. Subjects may be expanded as needed. For example, a folder on "Surveying" can be separated into the headings of "Levels," "Land Lines," "Topography," "Computations" and "Costs." Other similar separations can be made when a file becomes too voluminous. One advantage of the scheme is that when going through a folder in search of some item, one often finds something else of interest that has been filed and forgotten.

An alphabetic subject system is the easiest to use. New subjects are readily inserted. Folders may be numbered to assist in replacement in the file. In picking out suitable numbers, the use of a dictionary containing 10,000 numbered words will avoid the necessity of renumbering the folders when additional subjects are inserted. A card index is not necessary, and its omission saves a lot of work. The file folders are in the same order as the cards would be, and the items filed in the folders are immediately available. Legal-size file folders are the handiest size, particularly if maps or drawings are included. A regular vertical file, a paper transfer case, or a box that can be locked for shipment from job to job will be adequate to keep the folders accessible.

Put the file subject or number on the article in red to aid in refiling. Clip all sheets of each article together so that they will not get lost. If your friends borrow your data, put your name on each item to help them remember to bring it back. Keep the list of subjects handy for both filing and reference. Here are the subjects:

Abrasives
Accounting
Acoustics
Addresses
Agriculture
Air Conditioning
Architecture
Art
Astronomy
Automobiles
Aviation
Blasting
Boilers
Books
Bridges & Cableways
Buildings
Catalogs, Price Lists, etc.
Chemistry & Chem. Engineering
Civil Engineering
Clay Products
Civil Service
Clearing of Land
Concrete
Construction & Progress Control
Contracts
Correspondence with Individuals (in alphabetical order)
Costs
Cranes
Culverts
Dams
Design
Docks
Drafting
Drainage (also see Culverts)
Dredging
Drilling
Electrical Engineering
Employment
Engines, gas, oil, steam
Equipment & Supplies—Field & Office
Erosion
Estimates
Excavation
Filing & Record Systems
Floods & Control
Forestry
Forms for Computation, etc.
Foundations
Gages & Stream Gaging
Geodesy
Geology, Well Logs (also see Drilling)
Government Price Lists of Publications
Health
Heating (also see Air Conditioning)
Highways
Houses
Hydraulic Engineering
Income Tax
Insurance
Irrigation
Land & Land Acquisition
Legal
Lighting
Lightning
Lubrication
Lumber & Plywood
Machinery
Manufacturing
Maps & Profiles
Materials
Mathematics & Statistics
Mechanical Engineering
Mosquitoes
Motors
Navigation & Boats
Noise
Office & Job Training
Optics
Organization
Paints & Painting
Patents
Photography
Pipe & Sprinklers
Planting
Plumbing
Power
Precipitation (also see Weather)
Printing, Process, Methods
Property
Pumps
Radio
Railroads
Reports
Reservoirs
Rivers
Rubber
Safety & First Aid
Salvage
Sanitation
Seepage
Sewers & Sewage
Shipping
Silting
Societies
Soils
Specifications
Structural Engineering
Sun Spots & Weather Cycles
Surveying
Tools
Trees
Tunnels
Ventilation (also see Air Conditioning)
Vibration
Water
Weather
Welding
Writing, Articles, Grammar, Speaking, etc.

Make up a set of file folders, adding other subjects of interest to you, and start filing. The next time you want that good idea you saw in CIVIL ENGINEERING last year, there will be no need to hunt; just get the clipping or a reference to the year, month and page from the file.

The subject and name index published each year for CIVIL ENGINEERING should be of considerable help in compiling the personal data file suggested here. The index for Volume 17 (1947) is now available on request to ASCE Headquarters.—Editor

...THE READERS Write

Claims Numerous Multiple-Purpose Dams Antedate TVA Project

TO THE EDITOR: The subject matter of the article by Erwin E. Shalowitz, entitled "Palestine's Jordan River Valley Plan Emulates TVA Development," in the September issue, was of considerable interest to me and to the engineers employed by the Bureau of Reclamation. Two statements in the article are in error, however, and I believe it would correct some possible misunderstanding to publish this discussion.

The following statement appears in the third paragraph of Mr. Shalowitz' article, "Until the advent of the TVA, men built dams upon streams solely to develop power, and the location of one dam had no relation to the location of any other on the same river system." The first part of this statement is obviously incorrect. Dams were built for irrigation, municipal and industrial water supply, and flood control long before the advent of TVA.

Since 1902 the Bureau of Reclamation has been building and operating irrigation dams and multiple-purpose dams for irrigation, power and other uses. Among the major dams constructed by the Bureau before 1933, the date of the TVA Act, were: Arrowrock Dam on the Boise River, Idaho (1915); American Falls Dam on the Snake River, Idaho (1927); Lahontan Dam on the Carson River, Nevada (1915); Pathfinder Dam on the North Platte River, Wyoming (1909); Owyhee Dam on the Owyhee River, Oregon (1932); Elephant Butte Dam on the Rio Grande, New Mexico (1916); Roosevelt Dam on the Salt River, Arizona (1911); Shoshone Dam (now called Buffalo Bill Dam) on the Shoshone River, Wyoming (1910); and many others. Other federal agencies, states, municipalities, and private interests have also been building dams for many years for uses other than power generation.

The second half of the quoted statement, too, is not strictly accurate. To mention a few examples of coordinated river development, I could point to the irrigation storage systems of the Salt and Gila rivers in Arizona, the Yakima River in Washington, and the Boise and Snake rivers in Idaho, and to the work of other agencies, such as the flood control and navigation works in the Ohio and Mississippi River valleys including the well-known Miami Conservancy District. It is true that the concept of comprehensive basin development has advanced and expanded in recent years, but the basic principles have been recognized, and in numerous instances utilized, by the Bureau of Reclamation and other agencies for many years.

The final paragraph begins "Just as the Tennessee Valley Authority has become the model for water conservation and reclamation projects throughout our country..." As the Tennessee Valley is a humid area, reclamation, in the sense of irrigation, is not practiced extensively there. It would seem much more to the point to compare the proposed Jordan Valley developments to the Central Valley Project in California, or to one of the other major coordinated developments where irrigation and power are the primary functions.

WESLEY R. NELSON, M. ASCE
Asst. Commissioner, U.S. Bureau of Reclamation
Washington, D.C.

Plan for Developing Jordan River Valley Outlined

TO THE EDITOR: I read with interest Mr. Shalowitz's article in the September issue.

The fact that there is a difference of 1,300 ft between sea level and the lower level of the Dead Sea gives almost every technically inclined person an idea of the hydroelectric power possibilities in the country. The idea of generating hydro power there was first suggested about 50 years ago by Theodor Herzl, founder of the Zionist movement, at a conference in Basel.

A quarter of a century ago, the Norwegian engineer, Albert Hjorth, designed a power and irrigation project that called for conducting water from the Mediterranean, by means of canals and tunnels, to the Dead Sea to generate hydro power, and for diverting the water of the Jordan for irrigation, in connection with a system of wells and reservoirs. The project was described by Lewis R. Freeman in the June 1922 issue of *Popular Mechanics*. In 1944 Dr. Walter Clay Lowdermilk outlined a somewhat similar project in his excellently written book, *Palestine, Land of Promise*, without knowing about the preceding project. If those plans had been realized, the influx of rain and the water from rivers, plus that from the turbines, would have raised the level of the Dead Sea and inundated its shores, if the turbines were not stopped. In any case, the output of power would have been very low.

The November 1937 issue of *Palestine and the Middle East* carried an interview with the water-works expert, Dr. Eng. A. Werber, under the title, "The Haifa-Aqaba Canal, Possibilities of a New Waterway to the East." In the same interview, Lord Strickland was quoted as favoring a canal from Gaza to Aqaba. Both canals would have required considerable water power to sluice the ships over the heights in the Negew, and no power at all would have been available for irrigation and industry.

Ten years ago I designed a comprehensive canal, power and irrigation project that takes into consideration the best use of the many topographical, geological and geographical peculiarities that abound in Palestine. My scheme, which would permit development by section, as political and financial circumstances permit, takes into account existing and projected gravity-flow irrigation projects as well as river-power possibilities.

The project, outlined in part in the August 1946 issue of *The Jewish Forum*, would provide for Palestine:

1. Inland waterways, navigable for ocean liners.
2. Express railroads, highways, airdromes, fire- and bomb-proof store depots cut in the rock, and protected pipelines for oil along the canal banks.
3. Hydroelectric power plants, with 1,000,000 hp or 6,500,000,000 kwhr of electric current a year (Dr. Lowdermilk's project provides 120,000 hp or 1,000,000,000 kwhr).
4. All-year accumulation of rain and river water throughout Palestine and the whole watershed of the Dead Sea, with irrigation systems for agricultural, industrial and residential areas.

My project would also offer trade inducements of value to the industrious nations of the world, and would be contributive to lasting peace in the Middle East by uniting divergent peoples in useful and constructive work.

WILLY WM. SALMON
New York, N.Y.

Asks for Revised Building Code for New York State

TO THE EDITOR: A New York State legislative committee has been appointed to study the adoption of a Statewide Building Code. Practicing engineers wishing to express their views on the subject should write to Senator William F. Condon, chairman, New York State Joint Legislative Committee on Statewide Building Codes, 30 South Broadway, Yonkers, N.Y. The following is a revised abstraction of a letter the writer sent to Senator Condon:

The effect of building construction codes on the cost of construction depends upon the condition of the code. In actual figures, a code which is ten years behind the times can increase construction costs 25 percent and thus waste that much of human and natural resources. Despite recent revisions, present codes are about ten years behind the times in the sense that the revisions could have been made ten years ago.

Most, if not all, of the present building codes restrict initiative in design. It would be well if the State of New York consulted private American engineering consultants regarding .European and, particularly, South American practices which are noted for boldness and utility and outstandingly efficient designs, despite the limited capacity of production. These examples merely prove what can be done. However, we do not have to go abroad to seek initiative.

A state building and zoning law can accomplish much by introducing measures designed to protect the health and well-being of its citizens. Zoning, for instance, could specify a certain minimum amount of green foliage for each occupant or user—say, 6 cu ft of foliage or 36 sq ft of vine or 36 sq ft of lawn per person—for Class A zoning with one-half as much for Class B and one-quarter as much for Class C. These requirements are not excessive in view of the fact that the ordinary suburban residential neighborhood has as much as 1,000 sq ft of lawn per person. In crowded business and industrial areas this would encourage plantings on set-backs, shelves, roofs, etc. Access should be provided to these areas.

Building codes should not be locally administered. They should be adequately illustrated with up-to-the-minute plans and sketches to illustrate every point possible. Each page of printed report should be followed by several pages of illustrations (pictures, photographs, plans, elevations, sections, diagrams, etc.). Color and the mediums employed every month in thousands of magazines and trade periodicals should be used to obtain an adequate presentation.

Allowable code unit stresses should be specified for high- and low-alloy steel as well as for stainless steels, other alloys and aluminum. Increase of column allowable stresses to the full value used for tension and bending is quite possible for rigid-frame construction, in addition to the ordinary live-load and wind-stress allowances (points of combined maximum moment and shear being well-braced).

Temperature stress allowances for rigid construction may be specified and indication given of acceptable methods to allow for them.

Air conditioning design should be carefully regulated as regards conditions affecting health. Foundation designs could be improved. Increases of from 50 to 100 percent in foundation costs resulting from inadequate codes are not uncommon. Smoke and dust control and abatement should also be considered and rigorously enforced in any comprehensive building code.

Additional points that should be considered in an up-to-date building, construction and planning code are: depreciation, replacement, modernization, limited service life design (say, 30 years), precast constructions, ratio and modular construction, and standardization of all measurements to feet and hundreths for building construction.

Motion pictures should be used in the education of the general public, the engineer, and engineering organizations, with respect to best practice in building codes, planning, production and construction. It would be well if the state taxed non-educational motion pictures to provide for the production of educational films to be used for the above purposes as well as for general visual training in schools, etc.

CHARLES W. DOHN, Jun. ASCE
Albany, N.Y.

Technical Books Requested for Library in Finland

DEAR SIR: Finland has an excellent and highly scientific technical institute, Teknillinen Korkeakoulu. During the war its library was bombed and totally destroyed.

On a recent trip to Finland for the American Friends Service Committee, I discussed the situation with Dr. Martti Levon, director of the institute. He said he would welcome gifts of scientific and technical books and periodicals from America to take the place of those destroyed.

In the remarkable effort for recovery that the Finns are making, the lack of technical library facilities is a very serious handicap. It would be a practical act of friendship to a nation that holds America in high regard if Americans would contribute good technical books and periodicals to this library.

Such gifts should be marked for the Institute of Technology, Helsinki, and sent to the Legation of Finland, 2144 Wyoming Ave., N.E., Washington, D.C. Dr. K. T. Jutila, the Finnish Minister, will make arrangements for shipping them to Finland.

ARTHUR E. MORGAN, M. ASCE
Member, American Friends Service Committee
Yellow Springs, Ohio

Says Employer-Employee Barriers Must Be Broken

TO THE EDITOR: I was interested in James W. Darling's comments in the September issue (page 44) on my article, "What Management Expects of an Engineer," in the June issue. In this article I did not attempt to outline or define the term "management," but I believe that the principles set forth in my discussion equally apply to all levels of management including the engineers in appraisal of those subordinate to them, and their problems.

Inevitably, I have not only personally experienced in my own work as an engineer and as an executive, but must daily cope with the age-old problem of personal jealousies, personal ambitions and other human relationships in the organization. I know there are many instances where the ideas and achievements of junior employees are appropriated or suppressed by superiors.

These are apparently some of the more unpleasant peculiarities of human nature, which crop out in situations involving intense competition among individuals. Such traits can probably never be eliminated, but they can be controlled if everyone is alert to the fact that they exist. I believe their effect can be very largely overcome through the medium of closer personal contact in all levels of management and by the encouragement of frequent meetings among management and supervisory forces, at which everyone is encouraged to present his ideas.

It is one of the fundamental tenets of good management that any man who rises to a position of responsibility in any organization does so to a large degree through the efforts of his subordinate coworkers and that he can maintain that position only by the same means.

A. C. RUBEL
Vice-President, Union Oil Company of California
Los Angeles, Calif.

Another Method Offered for Computing P.I. of Two Lines

DEAR SIR: I have read with interest the article by Henry G. Weissenstein, entitled, "Calculating Machine Furnishes Shortcut Method of Computing P.I. of Two Lines," which appeared in the September issue. This method no doubt saves time in computing the point of intersection, when a computing machine is available, compared with the sine law method.

Over a period of years I have used a computing machine method, which I believe is more direct for solving intersection and triangulation problems in a coordinated field, although perhaps it is no faster than the author's method. The solution is based upon the principle of closing a traverse through the two known points and the unknown point—that is, Σ departures = 0 and Σ latitudes = 0. Usually the problem of computing intersections occurs in land surveying, computation of paper location for highways, or work of a similar nature where traverses are being computed and tabulated on a form similar to Table I.

The same values for the known coordinates and bearings used by Mr. Weissenstein are tabulated in the table together with the unknown distances *Y–Z* and *Z–X*, which, for purposes of solution, are assigned the symbols *a* and *b*, respectively.

The problem is solved as follows:

Step 1. The differences of coordinates in the direction of *X* to *Y* are determined by subtraction. These values of −3,467.19 in the Eastings and +682.65 in the Northings are tabulated in Line 2, Cols. 7 and 8.

Step 2. Two simultaneous equations are set up, one equating Σ departures = 0, and the other equating Σ latitudes = 0. The equations are written by proceeding in order from one of the known points to the unknown point, then to the second known point and back to the point of beginning. In this case, *Y* to *Z*, *Z* to *X*, and *X* to *Y*. Using the symbols *a* and *b* for the unknown distances, we have:

For the Eastings,

$$+a \sin \text{N.80°32'12"E.} + b \text{ Sin S.17° 24'36"E.} - 3{,}467.19 = 0$$

For the Northings,

$$+a \text{ Cos N.80°32'15"E.} + b \text{ Cos S.17° 24'36"E.} + 682.65 = 0$$

Inserting the numerical values for the functions, with due regard to signs, we have

$$+0.9864388a + 0.2992073b - 3{,}467.19 = 0$$
$$+0.1641294a - 0.9541881b + 682.65 = 0$$

Step 3. Solving for *a*,

$$-0.9412482a - 0.2854977b + 3{,}308.351 = 0$$
$$+0.0491087a - 0.2854977b + 204.254 = 0$$
$$-0.9903569a + 3{,}104.097 = 0$$
$$a = 3{,}134.322$$

(Multiplying the values of *b* in the two equations by the coefficient of *b* in the opposite equation is not necessary since the terms cancel. This step has been shown for completeness.)

Step. 4. Insert the value 3,134.32 for *a* in Line 4, Col. 2, multiply by the values of the functions shown in Cols. 4 and 5, and tabulate the computed departures and latitudes for the course *Y–Z* in Cols. 6 and 8, respectively.

Step 5. Determine the algebraic sum of the departures and latitudes shown on Lines 2 and 4, and tabulate the results on Line 6 in the departures and latitudes columns so that Σ departure and Σ latitude equal zero. In this case, 375.37 in Col. 6 and 1,197.08 in Col. 9.

Step 6. Divide the value obtained above for Line 6, Col. 9, by the cosine of the bearing of *Z* to *X*, $\frac{1{,}197.08}{0.9541881}$, and tabulate the answer (1,254.55) in Line 6, Col. 2 for the value of *b*. The value in Col. 6 could have been divided by the sine of the bearing of *Z* to *X* to obtain *b*, but it will be found that more consistent results are obtained if the larger numbers are used to obtain the unknown distances.

Step 7. The solution is checked by multiplying the value obtained for *b* by the sine of the bearing (1,254.55 × 0.2992073 = 375.37). This result must always equal the value previously determined for the departure by subtraction (Col. 6) and affords an automatic check on the solution. (Occasionally, due to dropping figures in the last decimal place, the closure will not balance by 0.01 ft.)

Step 8. Compute and tabulate the total coordinates of point *Z* in Cols. 10 and 11.

If any function is incorrectly tabulated or any step in the computation is incorrectly performed, the values obtained by Steps 5 and 7 for the departure will not agree.

It will be noted that the computed length of line *Y–Z* differs from the author's determination by 0.01 ft. If the values determined by the author are used to compute a complete figure closure, it will be found that the figure will not close by 0.01 ft in the Northings. The discrepancy between the two solutions can probably be attributed to carryover of figures in the last decimal place. However, the method described here will provide a stronger solution than the author's method when the direction of either or both of the lines through the point of intersection approaches east or west because of the moderate rate of change of the sine and cosine functions for small changes (or error) in bearing, compared with the rate of change of the tangent function.

R. E. BURNETT, Assoc. M. ASCE
Engineer, U.S. Bureau of Reclamation
Escondido, Calif.

TABLE I. COMPUTATION AND TABULATION OF TRAVERSES

Line No.	Point (1)	Distance (2)	Bearing (3)	Sine (4)	Cosine (5)	Departure E(+) (6)	Departure W(−) (7)	Latitude N(+) (8)	Latitude S(−) (9)	Coordinates E (10)	Coordinates N (11)
1	*X*	.....	.....	.....	.....	.....	.....	.....	.....	−8,325.04	+12,843.77
2	...	.....	.....	.....	.....	.....	3,467.19	682.65	.....	.....	.....
3	*Y*	.....	.....	.....	.....	.....	.....	.....	.....	−11,792.23	+13,526.42
4	...	3,134.32	N.80°33'12" E	0.9864388	0.1641294	3,091.82	.....	514.43	.....	.....	.....
5	*Z*	.....	.....	.....	.....	.....	.....	.....	.....	−8,700.41	+14,040.85
6	...	1,254.55	S.17°24'36" E	0.2992073	0.9541881	375.37	.....	.....	1,197.08	.....	.....
7	*X*	.....	.....	.....	.....	.....	.....	.....	.....	−8,325.04	+12,843.77
					Totals	3,467.19	3,467.19	1,197.08	1,197.08		

Notes Revised Figures in Article on Bridge Tests

DEAR SIR: Referring to my recent article, "Wind-Tunnel Tests Reveal Serious Inadequacy of Present Bridge Specifications," in the October issue of CIVIL ENGINEERING, I wish to record a correction in Figs. 2 and 5. The vertical lift forces as plotted for girder sections should be divided by two. The other graphs and data in the article are unaffected (including the horizontal forces, the lift-drag ratios, and the overturning moments) and the conclusions and recommendations stand unchanged.

D. B. STEINMAN, M. ASCE
New York, N.Y.

Favors Simplification of ASCE Membership Grades

DEAR SIR: The current discussion of proposed changes in membership grades prompts my comment. As an obscure Associate Member who will never become a "Fellow," a "Dean" or even a Member, except through the operation of a grandfather provision of the constitution, my observations are without prejudice.

The substance of my opinion is that we are taking ourselves too seriously. We should all know that elevation to the grade of Honorary Member does not just happen. As in the field of politics, such exaltations are brought about by well-organized campaigns. In my judgment, the creation of a grade intermediate to Member and Honorary Member will be merely another stimulus to such procedures. One of the avowed purposes of the regrading of members is to wipe out the distinction between the grades of Associate Member and Member, and now it is proposed to create another distinction. The campaigns for preferment may well be in the making.

Of the same over-seriousness is the general pretension to professional standing. If it is desired to measure professional eminence by the standards of the accepted professions—the Church, the law and medicine—the criteria are well established in the minds and hearts of the public. Independent practice, technical competence, ethical conduct, and the placing of public service above personal gain are of the essence. Granted that engineering may be a profession if practiced under these specifications, the assumption that all engineers are professional men is a quaint fancy.

As a parting blast, calling an engineers' union by a soft name and disclaiming constitutional authority for the creation of it, fools nobody but ourselves.

F. H. WISEWELL, Assoc. M. ASCE
Buffalo, N.Y.

Construction Difficulties on Winton Dam Recalled

DEAR SIR: The article, entitled "Restoration Work Prolongs Life of Concrete Structures," by A. C. Giesecke, in the October issue, provides valuable information as to the methods of coping with problems arising from poor quality concrete. Since the article concerns several hydroelectric projects, on the original construction of which I was employed, some explanation of the poor quality of the concrete may be of interest and also appropriate for the purpose of protecting the reputation of the engineers engaged in the design and construction.

I was engaged as field and resident engineer by the consulting engineer who designed the Knife Falls, Scanlon, and Winton dams, which were built during the years 1920–1923. The construction of these dams was commenced before the Minnesota Light and Power Co. entered the power field in northern Minnesota and purchased most of the hydroelectric plants in the area. As I recall, the Knife Falls Dam was fully completed and the Scanlon and Winton dams were partially completed when the Minnesota Light and Power Co. took over.

Construction contracts were let to reputable contractors on a cost-plus-a-fee basis which, however, largely eliminated the authority of the consulting engineer so far as inspection of the concrete was concerned, the responsibility for the quality of the materials and the product being left almost entirely to the contractor.

The Knife Falls and Scanlon dams are relatively small structures, and it is my understanding that the damage to the concrete surfaces of those dams has not been extensive. The more remote Winton Dam, which is only a few miles from the Canadian Border in northeastern Minnesota, is much larger, containing about 20,000 cu yd of concrete. Most of the aggregate for this dam consisted of a screened but unwashed bank gravel, which was mixed in a central mixing plant on the site and distributed by spouts from a centrally located tower. This work was commenced in the summer of 1922 and continued through the following winter into the summer of the next year. Concrete was poured in temperatures as low as 20 deg below zero, and I still have numerous photographs of construction in my possession. However, the materials were well heated, and ample protection was provided by steam and salamander heat at the point of deposit. I doubt that any of this concrete was damaged by freezing during the curing period.

I do definitely recall protesting vehemently on several occasions to my superiors and to the contractor as to the quality, sizes, grading and proportions of the concrete, but their protests were to no avail and I was told that full responsibility for the concrete rested with the contractor. I left the work in April 1923 to take another position, where the engineer had responsibility and authority to enforce his specifications.

As Mr. Giesecke has stated, those were the days of the aftermath of World War I "when the cry was 'hurry, hurry, build the plant.' " It was no surprise to me some years later to visit Winton Dam and see for myself the disintegration in the concrete that I had prophesied during the construction period.

HENRY H. JEWELL, M. ASCE
Chevy Chase, Md.

Explains Functioning of Kansas Licensing Law

DEAR SIR: As a follow-up on my story about the new engineers' license law in Kansas, which appeared on page 57 of the June issue, I would like to offer the following information.

Under the old law, which did not "require" registration of engineers in Kansas, but left it optional, a total of 752 certificates was issued from the time the law went into effect in 1931 until July 1947. Of the 752 granted, 693 were original certificates and 59 were reciprocal certificates issued to engineers licensed in other states. As a result of deaths and lapses, there were 701 registered engineers at the time the new law went into effect.

In 1931, the first year the law was in effect, there were 20 engineers registered. The number jumped to 75 for the year 1933, and then slacked off until the low year of 1940 when only 20 were registered. After the war more and more engineers seemed interested in their professional standing, with 72 registering in 1946, and 77 in the first half of 1947.

Since Kansas is not an industrial state, the engineering work seems to be mainly civil engineering work. Of the 752 men registered in the state, 534 were registered as civils and 18 other as sanitary engineers, a branch of civil engineering. The nearest competitors were the electricals, who had 64 registered engineers in Kansas. There were 33 registered as structural engineers. Under the new law, all engineers will be licensed as "engineers" with no distinction made as to branch.

The Kansas State Board of Engineering Examiners has recently hired a man to maintain an office. Previously all work was done on a part-time basis by the secretary. The new employee will spend half his time on the work of the Board and the other half on the work of the Kansas Engineering Society, the two organizations having opened an office together in Topeka. The official work is now being done by the duly appointed members of the Board, and the routine work by the assistant secretary and his clerk. It will be interesting to see if the full-time office will promote the standing of the engineers of the state.

It is evident that the new Kansas law will not "open the gates" to all under the grandfather clause, since the number of applications for license has not increased too greatly under the law. In fact, there are not as many applications as had been expected. So far as is known, no women were registered previously, nor are any now applying for license.

ROBERT M. LINGO, Jun. ASCE
Publicity Chairman, Kansas Section, ASCE
Topeka, Kans.

SOCIETY NEWS

EDITORIAL:

Voluntary Contributions

ON THE ANNUAL bills of the ASCE now going forward to the membership, space is provided for making voluntary contributions to a special fund established by the Board of Direction at its Fall Meeting (see CIVIL ENGINEERING, November 1947, page 55).

While the establishment of this fund was effected at the same meeting of the Board at which was adopted the drastically curtailed and balanced budget for this fiscal year, it is by no means solely an expedient to tide the Society over the financial difficulties emphasized by the recent defeat of the proposed constitutional amendment to increase dues. The inception of this fund can be traced back over a number of years.

From time to time, suggestions have been made that machinery be established so that such members as desired to do so could make voluntary contributions to the Society. Many came from Life Members and Honorary Members, all of whom are exempt from payment of dues, but some of whom apparently felt that they would like to continue to make some monetary contribution to the Society. In addition, many in the dues-paying grades of membership made similar suggestions. Generally the utilization of such suggested voluntary contributions was associated with a special purpose, such as helping young men obtain a better footing in the civil engineering profession.

When the stringency of the Society's financial circumstances was accentuated early this year by discussions accompanying the constitutional amendment procedure whereby increased income was sought from dues, the number of suggestions for a voluntary contribution fund increased perceptibly. Taking cognizance of this fact, the Board of Direction, at its meeting in Phoenix last April, accepted a recommendation of its Executive Committee and authorized the appointment of a Committee on Voluntary Contributions. The purpose of this committee was to explore "the possibility of creating a special fund from voluntary contribution from Corporate Members of the Society, and possibly from others, for use in promoting interest in the Society on the part of young engineers." Past-President J. C. Stevens was named chairman of this committee. Members of the committee are A. P. Greensfelder, Hon. M.; Charles G. Hyde, Past-Director; H. D. Mendenhall, Past-Director; Henry E. Riggs, Past-President and Hon. M. Chairman Stevens, at the Summer Convention, reported that the Committee favored giving all members, rather than Life Members only, opportunity to contribute to a special fund.

As is made clear in the resolution establishing the "Loyalty Fund," such voluntary contributions will be credited to a special fund, and withdrawals therefrom shall be made only upon specific authorization of the Board of Direction for some special or urgent purpose.

Consultation with officers of two of the three other Founder Societies, namely, the American Society of Mechanical Engineers and the American Institute of Mining and Metallurgical Engineers, in which such voluntary contribution funds have been in existence for some time, pointed up the fact that many members of the engineering profession are desirous of "doing something extra" for their professional societies, but have been a bit self-conscious about making unsolicited individual contributions. The method adopted for making it possible for each individual, within his own means and wishes, to contribute to his professional society by so indicating on the annual bill, also follows the precedent established by some of our sister societies.

Board of Direction Elects Four Honorary Members

Honorary membership in the Society has been awarded to four engineers eminent in their respective fields: John B. Challies, Hardy Cross, William H. McAlpine, and Karl Terzaghi, all Members ASCE. Elevation to the Society's highest membership grade was authorized by the ASCE Board of Direction.

An authority in the field of water resources and power, Mr. Challies is vice-president of the Shawinigan Water and Power Co., Montreal. He founded the Dominion Power Board and the Hydrometric Survey of Canada, and has done important work in securing more adequate recognition for the professional engineer in Canada. He is a past-president of the Engineering Institute of Canada.

Hardy Cross, professor of civil engineering at Yale University, is widely known as an engineering teacher and as originator of the moment-distribution method of computing stresses in rigid frames. Author of numerous papers and reports on structural engineering subjects, Professor Cross received the Society's Norman Medal in 1934 and the Wason Medal of the American Concrete Institute in 1935.

William H. McAlpine, chief engineer in the Office of the Chief of Engineers, Washington, D.C., has served on consulting boards for all major river, harbor and flood control structures built by the Corps of Engineers during the past 20 years. At present Mr. McAlpine is a member of the boards of consultants for the Tennessee Valley Authority and for the Panama Canal.

An authority on soil mechanics, Dr. Terzaghi is widely known as a teacher, writer, and consultant in that field. He has been lecturer in the Harvard Graduate School of Engineering since 1938, and a year ago was appointed to fill the newly created chair of professor of the practice of civil engineering at that university. Author of many papers on soil mechanics, Dr. Terzaghi has been the recipient of the Society's Norman Medal three times.

Biographical sketches of these distinguished members will appear in the January 1948 issue of CIVIL ENGINEERING. Formal presentation of the honorary membership awards will be made at the Annual Meeting of the Society, in New York City, on January 21.

Professional Records of Nominees for ASCE Offices

CARLTON S. PROCTOR
Nominee for Vice-President, Zone I

JOHN W. CUNNINGHAM
Nominee for Vice-President, Zone IV

WILLIAM McK. GRIFFIN
Nominee for Director, District 1

EDMUND A. PRENTIS
Nominee for Director, District 1

JOEL D. JUSTIN
Nominee for Director, District 4

JULIAN HINDS
Nominee for Director, District 11

WEBSTER L. BENHAM
Nominee for Director, District 14

C. GLENN CAPPEL
Nominee for Director, District 15

CARLTON S. PROCTOR

A MEMBER OF the New York City consulting firm of Moran, Proctor, Freeman & Mueser, Carlton S. Proctor has a long record of professional and civic achievement. Following his graduation from Princeton University in 1915, with the degree of civil engineer, Mr. Proctor became superintendent of construction for the Washington branch office of McKenzie, Voorhees & Gmelin, New York City architects. In 1919, after wartime service as first lieutenant and captain in the Construction Division of the Army, he joined Daniel E. Moran, M. ASCE, in forming the consulting firm of Moran & Proctor, now Moran, Proctor, Freeman & Mueser.

Mr. Proctor's firm, which specializes in substructure engineering, has served as consultant on the design and construction of the foundations for such important projects as the Philadelphia-Camden Bridge, the Ambassador Bridge at Detroit, the Mid-Hudson Bridge, and the San Francisco–Oakland Bay Bridge. It has also acted as consultant on dam, powerhouse, and tunnel structures all over the United States and abroad, and on the foundations for a number of New York buildings and skyscrapers.

During World War II, Mr. Proctor had the rank of colonel in the Engineer Corps, serving as commanding officer of the 334th Engineer Regiment (S.S) and of the Desert District, Persian Gulf Command. He was decorated with the Legion of Merit and retired for line-of-duty disability.

Mr. Proctor has served the ASCE in many capacities. Elected an Associate Member in 1925 and Member in 1930, he was Director for District 1 from 1936 to 1938, and a member of the Executive Committee of the Board of Direction in the latter year. Other Society Committees, on which he has served, include the Security Committee (1936 to 1940) and the Committee on Private Engineering Practice (1944 to 1946). Active in the organization of the Soil Mechanics and Foundations Division, he was chairman of the Division from its organization in 1936 until 1942, when he resigned to enter the Army.

From 1930 to 1935 Mr. Proctor represented the Society on the Construction League of the United States, serving as its vice-chairman, and from 1932 to 1934 he was ASCE representative on the Code Committee of NRA. In the latter capacity, he was appointed chairman of the Engineers Code Committee. He was also ASCE appointee to the Engineers National Defense Board from 1940 to 1942.

During 1944 and 1945 Mr. Proctor was a member of the National Engineers Committee on the Industrial Disarmament of Germany which made a study and prepared a report for the U.S. Departments of State and War. A year later he served as chairman of a similar committee that reported to the State, War, and Navy De-

partments on the industrial disarmament of Japan. He continues to serve as chairman of the National Engineers Committee of Engineers Joint Council. For his work on the two industrial disarmament reports, he received the President's Certificate of Merit.

Mr. Proctor has been Construction League member of the U.S. Industrial Advisory Board, and from 1933 to 1938 he was on the New York City Construction Code Committee. He has served on the council of the American Institute of Consulting Engineers, and at present is a director of the New York Building Congress and director and vice-president of the Society of the Moles. He is also a director of the American and Foreign Power Co., of A.T.F., Inc., and of the First Federal Savings and Loan Association.

Active in Princeton alumni affairs, Mr. Proctor is past-president of the Alumni Association of Southern New York and of the Princeton Engineering Association, and a member of the Princeton University Graduate Council. Recently the university awarded him the honorary degree of doctor of engineering, citing him for his services as Engineer Officer in both World Wars and as an "outstanding authority on foundations, and engineer on some of the world's largest bridges."

JOHN W. CUNNINGHAM

JOHN W. CUNNINGHAM—head of the Portland, Ore., firm of John W. Cunningham and Associates—has devoted his entire professional career to the Pacific Northwest.

Educated in Michigan and Wisconsin, Mr. Cunningham received the degree of B.S. in civil engineering from the University of Wisconsin in 1908. In the following year he went to Spokane, Wash., where for the next three years he was employed as a draftsman and designer of heavy railroad structures for the North Coast Railroad Co. and the Oregon-Washington Railroad and Navigation Co. In 1912 and 1913 he was chief draftsman for the Kittitas Reclamation District at Ellensburg, Wash. Moving to Portland, Ore., in the latter year, he became draftsman for the Northwest Steel Co., later having charge of the design and construction of a new structural fabricating plant for the concern.

In 1915 he became associated with J. O. Baar in a consulting practice in Portland under the firm name of Baar & Cunningham. The firm was reorganized in 1935 as John W. Cunningham and Associates. In the 1917–1925 reclamation era in the Northwest, the firm handled a number of large irrigation, drainage, and diking projects. More recently its practice has been largely in the field of water supply, sewerage, and sewage treatment. Mr. Cunningham is now a member of the board in charge of design for the Portland intercepting sewer and sewage-treatment system.

During the recent war, Mr. Cunningham served as architect-engineer in charge of the design of a 35,000-soldier Army camp and of a large lighter-than-air station for the Navy. His firm designed the utilities for all the major shipyards and most of the larger housing projects in the Portland-Vancouver area.

Entering the Society as a Junior in 1909, Mr. Cunningham became an Associate Member in 1914 and a Member in 1925. He was ASCE Director for District 12 from 1941 to 1943, and since then has been a member of the Committee on Private Engineering Practice. He has also served as chairman of the committee. Active for many years in the affairs of the Oregon Section, he has gone through the various offices and served as president in 1933.

Mr. Cunningham's other professional affiliations include the Oregon Society of Engineers and the Oregon Chapter of the American Association of Engineers, which he has served as president, the Professional Engineers of Oregon and the American Water Works Association. He is also a member of Tau Beta Pi.

In the field of civic activity, Mr. Cunningham for many years has been a member of the Portland City Planning Commission and chairman of its parks and streets committees. A member of the Oregon State Board of Engineering Examiners since 1935, he has represented the organization on the National Council of State Boards of Engineering Examiners and is now its vice-president. He has also served on the Oregon Economic Council.

WILLIAM McK. GRIFFIN

AN AUTHORITY IN the field of tunnel building, William McK. Griffin has served on the construction of most of the great tunnel projects that connect the island of Manhattan with the other New York City boroughs. At present he is deputy chief engineer of the Triborough Bridge and Tunnel Authority on the planning and construction of the Brooklyn-Battery vehicular tunnel under the East River.

Graduating from Harvard University in 1905, with the degree of A.B., Mr. Griffin received the degree of S.B. in civil engineering from the Lawrence Scientific School at Harvard a year later. Immediately after completion of his graduate study, he came to New York City to work on the construction of the Pennsylvania Railroad tunnels under the East River. The work constituted the largest shield-driven tunnel project under compressed air undertaken in the United States up to that time.

Upon completion of the project in 1909, Mr. Griffin spent several years with New York City contracting companies and consulting engineers. During this period (1909 to 1916), his most important work was on pneumatic caisson foundations for many of New York's famous skyscrapers.

In 1916, when the City of New York had under construction several East River tunnels as part of its expanding rapid transit system, Mr. Griffin became associated with the Public Service Commission. He remained with the Commission and its successors until 1936, except for a four-year period from 1921 to 1925 when he was engaged in the planning of a proposed trunk-line railroad tunnel under New York Bay for the New York City Board of Estimate and Apportionment. During his long tenure with the Commission, he served in various capacities from resident engineer to division engineer on most of the seven pairs of compressed air, shield-driven rapid transit tunnels, constructed under the East River during those years, and on a three-tube tunnel under the Harlem River. In addition, he also served on the construction of several rock tunnels and cut-and-cover sections for New York subways.

In 1936 Mr. Griffin became deputy chief engineer of the New York City Tunnel Authority on the planning and construction of the Queens Midtown Vehicular Tunnel under the East River, which was completed in 1940. Construction of the Brooklyn-Battery Tunnel, started in 1940 with Mr. Griffin as deputy chief engineer, was suspended from 1943 to 1945 because of the war. It is now being completed by the Triborough Bridge and Tunnel Authority, successor to the New York City Tunnel Authority, of which Mr. Griffin is deputy chief engineer. This project, which will be the longest vehicular tunnel in the United States, is expected to be completed in 1949.

A member of the Society since 1923, Mr. Griffin has served on various ASCE committees and has been active in the work of the Metropolitan Section. He was president of the Section for the year 1944–1945.

EDMUND A. PRENTIS

A SPECIALIST IN the field of heavy construction work, Edmund A. Prentis has been a member of the New York engineering and construction firm of Spencer, White & Prentis since its organization in 1919. A native New Yorker, he attended New York schools and in 1906

graduated from the Columbia University School of Mines. For the next six years mining engineering positions took him all over the United States, Mexico and South America.

Since 1912 Mr. Prentis has devoted himself to civil engineering work. He was employed by contractors working for the City of New York on the construction of its dual subway system from 1912 to 1918, and during this period helped develop the invention of the "Pretest" underpinning system. After World War I, in which Mr. Prentis served as a naval officer, he joined with Lazarus White and Charles B. Spencer, Members ASCE, in organizing the firm of Spencer, White & Prentis, Inc. The company specializes in foundations, underpinning, locks, dams, cofferdams, tunnels, and other types of heavy engineering construction.

As chief engineer for the firm during the entire period of its existence, Mr. Prentis has been in charge of its construction projects all over the world. During World War II, he supervised the construction of a system of communications from the head of the Persian Gulf into Persia and of two large airfields in the Bahamas, both projects of the Army Corps of Engineers; the construction of three great drydocks at Philadelphia and Norfolk for the Navy Department; and the construction of more than a hundred 21,000-ton oil tankers for the Maritime Commission.

At present, in addition to being chief engineer and director of Spencer, White & Prentis, he is president of the River Construction Corp., which is building the $17,000,000 twin lock No. 27 on the Mississippi River near St. Louis. He is, also, a director of the San Luis Mining Co., in Lima, Peru.

Well known as an author on foundation engineering subjects, Mr. Prentis has published three books in his field—*Modern Underpinning* (1917), *Underpinning* (1931), and *Cofferdams* (1940). Honors accorded him include the 1942 Moles award for "distinguished achievement in construction" and a recent citation for meritorious wartime civilian service from the Navy Bureau of Yards and Docks.

Mr. Prentis joined the American Society of Civil Engineers as a Member in 1919. His other professional affiliations include membership in the American Institute of Mining and Metallurgical Engineers, the honorary societies of Sigma Xi and Tau Beta Pi, and the Engineering Foundation, of which he is a director. He is also a member and past-president of the American Standards Association, the Columbia University Club, and the Columbia University Engineering Alumni Association, and a former trustee of Columbia University.

JOEL D. JUSTIN

A CONSULTING ENGINEER, specializing in dams, hydroelectric power and flood control, Joel D. Justin is a member of the Philadelphia, Pa., firm of Justin & Courtney.

Mr. Justin graduated from Cornell University in 1906, with the degree of C.E. A year later he entered the employ of the New York Board of Water Supply in the capacity of assistant engineer on dam construction. In 1911 he became principal engineer for the Board of Public Works, Harrisburg, Pa., and later was assistant to James H. Fuertes, New York City consultant, on water supply, filtration and sewerage work. During the period, 1914–1932, Mr. Justin filled several positions with engineering organizations and power companies in the field of water supply and hydroelectric power. As hydroelectric engineer for the United Gas Improvement Co., Philadelphia, he was in general charge of hydro power investigation, design, construction and operation.

Since 1932 Mr. Justin has been in private practice in Philadelphia—recently in partnership with Neville C. Courtney, M. ASCE. He has served as consultant on the construction or rehabilitation of more than 120 dams, including Glenville and Nantahala dams in North Carolina for the Aluminum Company of America; Arkabutla Dam in Mississippi for the Army Corps of Engineers; Cooper River Tidal Dam for the Camden (N.J.) Park Commission; La Regadera Dam, Bogota, Colombia; Clearwater, Nimrod, Blue Mountain and Norfork dams in Arkansas and Missouri; Caddoa Dam in Colorado; and Conchas Dam in New Mexico. He was also chairman of the board of consulting engineers that investigated slides at Fort Peck Dam and determined methods of reconstruction.

Other notable projects on which Mr. Justin has acted as consulting engineer include the Connecticut Flood Control Project, involving construction of 20 dams; the Buzzard Roost Power Project in South Carolina; the Merrimack River Flood Control Project in New Hampshire; the Santee Cooper Power Project in South Carolina; the Clark Hill Power Project in Georgia-South Carolina; the Muskingum Flood Control Project for the Army Corps of Engineers; and the Denison Power and Flood Control Project on the Red River.

Mr. Justin has been a member of the Board of Consultants for the Panama Canal since the board was established early in 1946.

Joining the Society as an Associate Member in 1911, Mr. Justin became a full member in 1916. He has served on various ASCE technical committees, and at present is chairman of the Power Division. He is also a Society representative on the board of Engineering Foundation.

Contributor of numerous papers to ASCE and other technical publications, Mr. Justin received the Society's J. James R. Croes Medal in 1924 for a paper on "Design of Earth Dams," and the Fuertes Gold Medal from Cornell University in 1932. He is author of *Earth Dam Projects*, published in 1932, and co-author of the *Hydroelectric Handbook*, Creager and Justin (1927), *Power Supply Economics*, Justin and Mervine (1934), and *Engineering for Dams*, Creager, Justin, and Hinds (1945).

JULIAN HINDS

AN AUTHORITY IN the field of water supply, Julian Hinds has been with the Metropolitan Water District of Southern California since the inception of the project in 1928. His present position is that of general manager and chief engineer.

Mr. Hinds graduated from the University of Texas in 1908, with the degree of civil engineer. Following graduation, he served as instructor in civil engineering and drawing at that institution for a year. His first practical engineering experience was in railroading—with the Southern Pacific, the Gulf, Texas & Western Railway and the Chicago, Milwaukee & St. Paul.

In 1910 he joined the U. S. Reclamation Service (now the Bureau of Reclamation) in Sunnyside, Wash., where he was engaged in the design of distribution canals, laterals and structures. His next assignment was as office engineer on the construction of Elephant Butte Dam at Elephant Butte, N.Mex. In 1915 he was transferred to the Bureau's newly established engineering office in Denver, Colo., where he served as designer, chief draftsman and assistant chief designing engineer on a wide variety of assignments involved in Western reclamation.

In 1926 Mr. Hinds joined the J. G. White Engineering Corp. on hydraulic work for the Republic of Mexico, where he was in charge of investigating, planning, and building the Calles Project in the State of Aguascalientes. This project involved construction of a massive arch storage dam, a multiple-arch diversion dam, and a system of main canals and laterals with various appurtenant structures. Mr. Hinds also served in an advisory capacity on other projects in Mexico, including the Don Martin Dam, a pioneer in the round-head buttress field.

The phenomenal growth of Los Angeles in the nineteen twenties brought home to the residents of Southern California the necessity of expanding their water supply by going to the one untapped source available—the Colorado

River. Following formation of the Metropolitan Water District of Southern California in 1928, reconnaissance work was started on storage works and an aqueduct to bring water from the Colorado to the coastal area.

Mr. Hinds first served the project in the capacity of designing engineer in charge of office work on preliminary investigations, designs and estimates for the proposed Colorado River aqueduct. Later, as chief designing engineer, he was in charge of the preparation of final designs and specifications for the project, consisting of a number of reservoirs, five major pumping plants, and more than 300 miles of waterways. In the position of assistant chief engineer, during the latter part of the construction period, Mr. Hinds took over much of the administrative work on the project. Since its completion, in 1941, he has been general manager and chief engineer.

Elected to membership in the Society in 1923, Mr. Hinds has served on several technical committees of the ASCE and is at present a member of the executive committee of the Hydraulics Division. He has also served the Los Angeles Section in numerous capacities, and held the office of president in 1943. Author of many papers in ASCE and other publications, Mr. Hinds was awarded the Norman Medal in 1926 for his paper on "Side Channel Spillways." He is co-author of *Engineering for Dam*, with William P. Creager and Joel D. Justin, Members ASCE, and a contributor to the *Handbook of Applied Hydraulics* by Calvin V. Davis, M. ASCE.

Mr. Hinds' other affiliations include membership in the American Water Works Association, Tau Beta Pi, Sigma Xi, the Los Angeles Chamber of Commerce and the California State Chamber of Commerce. He is a licensed civil engineer in California, and in 1940–1941 was a member of the California State Board of Examiners for Civil Engineers.

WEBSTER L. BENHAM

WEBSTER L. BENHAM, head of the Benham Engineering Co., Oklahoma City, Okla., has been in charge of many important municipal and industrial projects in the West and Southwest.

Graduating from Trinity School, New York City, in 1901, Mr. Benham was valedictorian of his class and received the McVickar Prize for Scholarship. He also won the J. Pierpont Morgan Scholarship to Columbia University, where he graduated in 1905 with the degree of C.E. In 1906, after brief positions as assistant superintendent of buildings and grounds at Columbia University and as engineer for the New Jersey Zinc Co., at Franklin Furnace, N.J., he became a member of the Oklahoma City civil engineering firm of Benham & Adams. He served as assistant city engineer for Oklahoma City in 1907 and 1908, and was engineer for Morris & Co., packers, in constructing a packing plant in Oklahoma City in 1909 and 1910.

During World War I, Mr. Benham served with the rank of major in the Construction Division of the Army, in charge of utilities and construction at Camp Funston, Kans., and as supervising utilities officer for 12 major camps and cantonments in the Southwest. At present he is a lieutenant colonel in the Engineers' Reserve (inactive).

From 1919 to 1922 Mr. Benham was a member of the firm of Johnson & Benham with offices in Kansas City, Mo., and New York City. The firm, which specialized in municipal and industrial practice, handled a number of projects in the East and in the Southwest. While in Kansas City Mr. Benham served on the Board of Advisory Engineers on a $12,000,000 water-works improvement program for that city.

As director of operations and chief engineer of the WPA for Oklahoma from 1935 to 1938, Mr. Benham was in charge of a design and construction program totaling $125,000,000. In 1940 he was a member of an Oklahoma City board of engineers, reporting on a new water supply and water-works improvement program for the city. At various times he has also served as consulting engineer for the city on problems of water works, and sanitary and storm sewers.

At present Mr. Benham is senior member of the firm of the Benham Engineering Co., which has been in operation since 1909. His son, David B. Benham, Assoc. M. ASCE, is the junior member of the firm. With a wide practice in municipal and industrial work, the firm has served several hundred municipalities in the states of Oklahoma, Texas, Nevada, Colorado, Arizona, Kansas, Missouri, Arkansas and Louisiana, specializing particularly in sanitary sewers, sewage treatment plants, and water supply distribution and purification. At the present time the firm is consultant for Oklahoma City on main sanitary sewers and sewage treatment plants, for which bonds to the amount of $9,000,000 have been voted.

During World War II, the Benham Engineering Co. was employed as architect-engineer for the War Department on the planning, design and supervision of construction of Camp Livingston, South Camp Polk and North Camp Polk in Louisiana, and of improvements, including the airport, at Camp Beauregard, La. The firm also did minor work at Tinker Army Air Field at Oklahoma City. The defense work of the firm totaled approximately $75,000,000.

A life member of the ASCE, of which he has been a full member since 1914, Mr. Benham has been active in the affairs of the Oklahoma Section. He is a past-president of the Oklahoma Society of Engineers, and former director and past-president of the American Association of Engineers. In 1925 he received the latter organization's Award of Merit for the most distinguished service rendered to the profession and the community during 1924. His other affiliations include membership in the Oklahoma Society of Professional Engineers, the American Water Works Association, the Oklahoma Water and Sewage Conference, the National Society of Professional Engineers, the American Society for Testing Materials, and Tau Beta Pi.

C. GLENN CAPPEL

C GLENN CAPPEL—member of the New Orleans engineering and contracting firm of W. Horace Williams Co.—has a wide range of design and construction experience. Inventor of a device to increase the load-carrying capacity of frictional piles in foundation conditions ordinarily considered unsafe, he has been particularly interested in the problem of wharf building on the lower Mississippi and in foundation conditions in the Gulf Coast area, including the construction of offshore oil-drilling platforms in the Gulf of Mexico. He is also the inventor of a method for protecting piles against destructive marine life.

Graduating from Louisiana State University in 1912, with the degree of B.S. in civil engineering, Mr. Cappel then went to Rensselaer Polytechnic Institute for postgraduate work in structural design. In 1914, after a brief period in railroad maintenance and dam construction, he entered the employ of the Louisiana Highway Department—first as resident engineer and, later, as bridge engineer. In the latter capacity, Mr. Cappel developed standards for concrete bridge and culvert design that were used for many years in Louisiana and other Southern states.

During World War I, Mr. Cappel served as chief inspector on the construction of the New Orleans Army Supply Base, comprising three large reinforced concrete warehouses. Later he was structural engineer for the New Orleans architectural firm of Favrot & Livaudais, and in 1920 he went to Mexico for Doullut & Williams Co., in the capacity of assistant general manager and chief engineer on a large terminal project. Returning to the United States in 1921, he served as manager of the building department of Doullut & Williams until the dissolution of the firm in 1924.

Mr. Cappel then became vice-president of the W. Horace Williams Co., which has continued in the engineering-contracting field to date with no change except that

from corporation to partnership in 1940. Since the latter year he has been a member of the firm.

During World War II, Mr. Cappel was in direct charge for his company of the construction of both Army and Navy projects, including Camp Claiborne, Camp Polk, the Belle Chasse Ammunition Depot, and the Naval Air Station (LTA) at Houma, La. For the latter project, he received a Meritorious Civilian Award from the Navy in 1944. Mr. Cappel recently completed an assignment from the City of New Orleans as chairman of a committee on the revision of the New Orleans Building Code, for which the city has awarded him a Certificate of Merit.

Elected an Associate Member of the Society in 1920, Mr. Cappel became a full member in 1924. He has contributed numerous papers to ASCE and other technical publications, and in 1945 was awarded the Society's Construction Engineering Prize for a paper entitled "Timber Hangar Erected from 16-Story Scaffold." Long active in the Louisiana Section, he served as president in 1946 and is currently on its board of direction. Mr. Cappel is also a past-president and former director of the Louisiana Engineering Society, and a special lecturer at the University of Mississippi.

Though Unaware of Its Existence, Life Member Starts "Loyalty Fund"

FIRST CONTRIBUTION credited to the newly established "Loyalty Fund" (see CIVIL ENGINEERING, November 1947, page 55) came from Joel D. Justin, Philadelphia, Life Member, ASCE, and was made before Mr. Justin knew of the existence of such a fund.

Sending his check for $20 to Society Headquarters, Mr. Justin wrote the following letter to Col. William N. Carey, Executive Secretary of ASCE:

"I have noted that the proposal to increase the dues of the American Society of Civil Engineers five dollars was defeated by the vote of the members of the Society. I was very much astonished at this as all the members must realize that the cost of the Society has increased the same as everything else.

"I suggest that you call on the Life Members of whom, I believe, there are something like 2,000 and suggest that those who want to, voluntarily continue the payment of the annual dues.

"In the Philadelphia District, about two years ago, we realized the Section was a little short of funds for local activities and we circularized the Life Members in this District with the result that some 35 Life Members now pay their local dues annually. I believe the total number of Life Members in this District is not more than 80.

"Mr. Henry Sherman of Camden recently spoke to me about this same idea. He is also a Life Member and said he thought that all Life Members who were in active engineering work would be glad to contribute.

"As a start, I enclose check for $20.00 which would be my annual dues if I were still continuing to pay dues."

United Engineering Trustees Elects New Slate of Officers

ELECTED AS PRESIDENT of the United Engineering Trustees, Inc., J. Schuyler Casey, president of the M. H. Treadwell Co., Inc., New York, engineers, took office on October 23, 1947, to serve for a period of one year. Mr. Casey, a member of The American Society of Mechanical Engineers, is also president of the Treadwell Construction Co., Midland, Pa., and chairman of the board of directors of the Treadwell Engineering Co., Easton, Pa. He succeeds J. P. H. Perry, M. ASCE, vice-president of the Turner Construction Co., who served as president of United Engineering Trustees from 1945 to 1947.

Other officers elected were Gen. William H. Harrison (AIEE), vice-president and chief engineer of the American Telephone and Telegraph Co., New York, and director of procurement and distribution service, Office of Chief Signal Officer, Washington, D.C. (reelected) as vice-president; Edward C. Meagher (AIME), assistant to the president, Texas Gulf Sulphur Co., New York, as vice-president; Kurt W. Jappe (ASME), retired director of purchases, Hercules Powder Co., Wilmington, Del., and treasurer of The American Society of Mechanical Engineers, as treasurer; and James L. Head (AIME), Department of Mines, Chile Exploration Co., New York, as assistant treasurer. John H. R. Arms (AIME, ASME) was reelected secretary.

Major Irving V. A. Huie, Director of ASCE, president of the Board of Water Supply, New York, will head the Real Estate Committee, which includes Col. William N. Carey, Executive Secretary of ASCE; Everett S. Lee (AIEE), engineer in charge, General Engineering Laboratories of the General Electric Co., Schenectady; as well as Mr. Head, Mr. Jappe and Mr. Casey.

George L. Knight (ASME), retired vice-president of the Brooklyn Edison Co., will serve as chairman of the Finance Committee. Other members will be Major Huie, Mr. Meagher, Mr. Jappe, General Harrison and Mr. Casey.

United Engineering Trustees is a corporation set up jointly by the four national engineering Founder Societies, which have an aggregate membership of about 88,000. These societies are: American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, The American Society of Mechanical Engineers, and American Institute of Electrical Engineers.

UET promotes the advancement of the engineering arts and sciences in all their branches, through two departments, the Engineering Foundation and the Engineering Societies Library. The corporation is the titular owner of the Engineering Societies Building and of the trust funds of the Library, the Foundation, the John Fritz Medal Board of Award, and the Daniel Guggenheim Medal Board of Award.

Mechanics Monthly to Review World's Literature

PUBLICATION IN JANUARY by the American Society of Mechanical Engineers of a new scientific monthly, the *Applied Mechanics Reviews*, will enable readers to keep abreast of new developments through review and criticism of current world literature in mechanics. Material for the journal will be selected from more than 500 magazines in various countries. Reviews by foreign writers will be translated into English for publication.

Supervision of the new journal's policy will be exercised by a committee representing several national scientific and professional organizations including the ASCE, Society for Experimental Stress Analysis, American Institute of Physics, Institute of Aeronautical Sciences and American Mathematical Society.

Editorship of the new publication will be in the hands of Lloyd H. Donnell, research professor of mechanics at Illinois Institute of Technology under whose department all editorial work will be handled. Dr. S. Timoshenko of Stanford University, a leading figure in the field of applied mechanics, will serve as editorial consultant. Illinois Institute of Technology, the Engineering Foundation of New York and the Office of Naval Research in Washington are actively supporting publication of the magazine.

Compromise Between President and Congress Needed for National Science Foundation

WATSON DAVIS

Director, Science Service, Washington, D.C.

BECAUSE CONGRESS and the President could not agree about how to run a National Science Foundation, the nation is without strong government support of the kind of fundamental scientific research that may decide between future abundant life and disastrous destruction of civilization. Congress passed a bill during its last session that provided a foundation controlled by a board of two dozen part-time members, but President Truman vetoed it because he wanted it run by an administrator with an advisory board. (See CIVIL ENGINEERING for September 1947, page 45.)

The next session of Congress will have the same line-up and players. There is not much hope that either side, President or Congress, will adopt the other's plan. Scientists and the public, polls and inquiries have shown, want science to advance with government support. They want essentially civilian direction of scientific research, despite the necessary accelerated development of science for military use and the stop-gap grants being given munificently by the armed forces to universities and other laboratories.

So, Mr. President and Mr. Congressmen, how about a new plan? Could you get together, for the sake of the nation, on some such scheme as this:

1. For the controlling body, authorize a U.S. National Science Commission of five full-time members. The commission form of organization is a workable, approved method of government administration, as in the Atomic Energy Commission, the Federal Trade Commission, the Federal Communication Commission, the Federal Power Commission, etc.

2. Incorporate in the new bill for a National Science Commission the salient features of the bill that passed in the last session, modified as necessary to be acceptable to both the President and Congressional leaders.

3. Invite all members of Congress to join in introducing the bill in the next session of the 80th Congress. There is excellent precedent for this unity for science. In the 75th Congress, S. 2067 "authorizing the Surgeon General of the U.S. Public Health Service to control and prevent the spread of the disease of cancer" was introduced jointly by every member of the Senate. The bill passed. Few members of the present Congress will wish to go on record "against science" in this atomic age, just as in 1937 no member of the Senate could afford to be in favor of cancer.

Mr. Truman, why not ask the Senate and House backers of the National Science Foundation bill to confer with you? This is an international emergency, as important in the long pull as filling empty human stomachs.

SALLY PORT of old Fort San Marco in St. Augustine, Florida, forms background for group from Jacksonville Fall Meeting which visited fort on Friday excursion. Pictured are, left to right: D. L. Wilson, Puerto Rico; Harold D. Van Vranken, vice-chairman, Fall Meeting committee; Mrs. Van Vranken; Miss Vivian Cameron; Robert M. Angas, chairman, Fall Meeting committee; Howard T. Critchlow, Director ASCE; Mrs. and Mr. Perley A. Rice, Richmond, Va.; Miss Lucy Wilson; Mrs. Critchlow; Mrs. and Col. William N. Carey, Executive Secretary of ASCE.

VISITORS TO OCEANARIUM at Marine Studios during Jacksonville Meeting excursion are E. M. Titus and L. A. Schmidt, Jr., of the Tennessee Valley Section.

Engineers Club Gets Under Way in Washington, D.C.

ORGANIZED TO FILL a long-felt need in the engineering life of the nation's capital, the Engineers Club of Washington, D.C., was officially incorporated last summer and is now actively functioning with a charter membership of over 900 engineers.

Formation of such an organization has been under consideration for a long time and it was on January 18, 1946, that the first active step was taken. On that date 24 engineers representing the local chapters of various engineering societies, including the District of Columbia Section of ASCE, met to elect a chairman and secretary and to appoint committees to investigate the organizations of similar clubs in other cities and possible existing buildings or proposed buildings suitable for a club home.

Later a questionnaire was mailed to about 7,000 engineers, members of the various engineering societies in the District of Columbia, to solicit opinions regarding dues, quarters and meals. In October 1946, regular monthly club luncheons were instituted and a committee was appointed to draft a constitution and by-laws. At a meeting in February 1947 the "Articles of Association" for the club were unanimously passed. Soon after, the closing date for charter membership was set as June 30, 1947.

During these months of activity, interest in the club steadily increased; attendance at meetings mounted from 18 at the first luncheon meeting in October 1946 to 165 at the April 1947 meeting. The highlight of the summer's activity was the incorporation of the club under the laws of the District of Columbia on July 31, 1947. Regular monthly meetings for the fall and winter seasons are now in full swing. A constitution and by-laws have been adopted, and at the November meeting nominations were made for the first regular officers of the club, who will be elected in December.

James W. Rickey Medal Established for Papers in Hydroelectric Field

A NEW SOCIETY AWARD—the James W. Rickey Medal for outstanding papers in the field of hydroelectric engineering—has been authorized by the ASCE Board of Direction. The Board accepted the offer of Mrs. Lucy M. Rickey, Washington, D.C., widow of the well-known hydroelectric engineer, to deliver to the Society $16,500 for the purpose of instituting a permanent fund for financing a medal in perpetuity in memory of Mr. Rickey.

Under the specifications for the new Rickey Medal, as the award is to be known, a medal may be given in any year for which one or more technical papers of sufficient merit and satisfactory coverage are eligible in the current volume of TRANSACTIONS. Open to non-members as well as members of the ASCE, the award is to be made for papers in the general field of hydroelectric engineering, including any of its branches, deemed to constitute an outstanding contribution to the art, with consideration both for the usefulness of the subject matter and the form of presentation. In any year, when the excellence of more than one paper justifies it, there may be designated a "second order of merit," with papers so recognized becoming eligible to compete in the award for the next succeeding year.

Responsibility for convassing the eligible papers and for recommending the winner or winners is vested in the then current Executive Committee of the Power Division, whose choice will be subject to ratification by the Board of Direction. The award will be a gold medal and an engraved certificate signed by the President and Executive Secretary of the Society. The specifications leave to the judgment of the Power Division officers whether, in case the medal is not awarded for a given year, an equivalent cash prize may be added to the following year's award.

Mr. Rickey, who retired from the Aluminum Co. of America on January 1, 1938, after eminent professional accomplishments in the field of hydroelectric engineering, joined the ASCE as an Associate Member September 3, 1902, became a Member on April 4, 1905, and had been an officer of the Society's Power Division. He died April 19, 1943.

Dutch Sponsor 1948 Soil Mechanics Conference

HOLLAND WILL BE HOST to the Second International Conference on Soil Mechanics and Foundation Engineering, which will be held in Rotterdam, June 21-30, 1948. This meeting, sponsored by the Netherlands Government, is a resumption of the series initiated at Harvard University in 1936 and interrupted by the war. Karl Terzaghi, M. ASCE, consulting engineer and professor of engineering practice at Harvard University, is president of the conference, which is being organized by J. P. Van Bruggen, director of public works, Rotterdam, T. K. Huizinga, director of the Laboratory of Soil Mechanics in Delft, and other Dutch engineers. The conference will be conducted in the English language.

In the United States, a National Committee on Soil Mechanics, consisting of 35 outstanding foundation engineers and soil mechanics experts representing professional engineering societies and governmental engineering organizations, has been formed. Philip C. Rutledge, Assoc. M. ASCE, professor of civil engineering at Northwestern University, is chairman of the committee. To insure adequate representation of the United States in the technical work of the conference, the National Committee has been divided into 15 subcommittees covering the major technical subdivisions of soil mechanics and foundation engineering.

Organized travel for those attending the conference is planned and will be arranged by the National Committee. Its official address is: U.S. National Committee on Soil Mechanics, The Technological Institute, Northwestern University, Evanston, Ill.

ASCE Member Heads N.Y. Volunteer Traffic Group

WITH "GETTING something done" about New York City's traffic problem as its goal, a Traffic Action Committee has been formed, with an ASCE member, Walter D. Binger, as chairman. Mr. Binger, former Commissioner of Manhattan Borough Works and now vice-president of the City Investing Corp., is to name a five-man executive committee to establish a program for the full group of 25, which includes transportation officials, union leaders, store executives and civic organization representatives.

Observing that the city's traffic treatment is spread among various city agencies, and that the police department "is incapable of making any radical contribution to the subject," Mr. Binger stated that "until we face the fact that the police can't do anything except say 'keep moving,' we won't get anywhere."

He suggested that responsibility for traffic control be centered in a Traffic Board to be appointed by Mayor William O'Dwyer.

Society Member Wins Award of John Fritz Medal

THEODOR VON KARMAN, M. ASCE, is this year's recipient of the John Fritz Medal, joint award of the four Founder Societies. A noted aeronautical engineer, Dr. von Karman is cited as "creative leader, stimulating teacher and wise counselor in engineering and physical research in the fields of the aeronautical and structural sciences, for his many applications of mathematical and physical theory to the sound solution of engineering problems."

Theodor von Karman

Dr. von Karman, a native of Hungary, was educated in Budapest and at the University of Goettingen in Germany, where he taught for several years. From 1912 to 1914 and from 1918 to 1930 he was on the engineering staff at the University of Aachen and director of the institution's aeronautical institute. Since 1930 he has been at the California Institute of Technology, where he is director of the Daniel Guggenheim Aeronautical Laboratory.

Recent honors accorded him include election to the British Royal Society and award of the honorary degree of doctor of science by Princeton University, which cited him as "consultant extraordinary to the aeronautical industry." Presentation of the John Fritz Medal will be made to Dr. von Karman at a later meeting of the American Society of Mechanical Engineers, of which he is a member.

CIVIL ENGINEERING Index for 1947 Is Available

Material appearing in the twelve issues of CIVIL ENGINEERING from January through December 1947, inclusive, is included in the index to Volume 17, now available without charge on request to Society Headquarters for those desirous of incorporating it in their 1947 bound volumes. Single copies of the index are sent to all subscribing libraries. Extra copies are available on request.

ASCE Members Represent U.S. at Brussels Meeting

AT A BUSINESS MEETING of the Permanent Commission of the Permanent International Association of Navigation Congresses held recently in Brussels, plans were discussed for the next International Congress of Navigation, to be held in Lisbon in 1949. At the congress papers will be presented by engineers interested in river and harbor improvement, and resolutions will be drawn up which may be said to represent prevailing international opinion on the technical subjects discussed.

Two ASCE members from Washington, D.C., represented the United States at the meeting of the Permanent Commission on October 7, 1947, the first held since 1939. The U.S. representatives were Col. C. L. Hall, Corps of Engineers, and H. G. Kuyl, chief engineer of the War Department's Board of Engineers for Rivers and Harbors.

The Permanent International Association of Navigation Congresses was founded in 1886 with the main purpose of holding periodically international congresses on technical subjects pertaining to navigation. Members of the Association are independent states, great public corporations and individuals, but power is vested in the Permanent Commission composed of representatives of subscribing states. Its headquarters office is in Brussels, where its bulletin is published.

A. B. Kinzel Again Heads Engineering Foundation

AT ITS ANNUAL MEETING, held in New York City on October 16, the Engineering Foundation reelected Dr. A. B. Kinzel, vice-president of the Union Carbide and Carbon Research Laboratories, as chairman for another year. Other officers reelected include Dr. L. W. Chubb, director of the Westinghouse Research Laboratories, as vice-chairman; Dr. Edwin H. Colpitts, director; and John H. R. Arms, secretary.

Reports were made at the meeting on 13 research projects aided by the Engineering Foundation during the past year. These projects were concerned with such varied fields as alloys of iron, metal cutting, welding, properties of gases, riveted and bolted structural joints, hydraulics and soil mechanics. Grants were recommended for the continuation of nine of these projects, and for the support of eight new ones.

The Research Procedure Committee will again be headed by Dr. Chubb, 1947 winner of the John Fritz Medal. Other members are Dr. Boris A. Bakhmeteff, Hon. M. ASCE, Frank F. Colcord, and Dr. J. F. Downie Smith.

NEWS OF LOCAL SECTIONS

Coming Events

Central Illinois—Meeting at the Abraham Lincoln Hotel, Springfield, Ill., December 3, at 8 p.m.

Central Ohio—Dinner meeting at the Chittenden Hotel, Columbus, Ohio, December 11, at 6 p.m. ASCE Director Daniel V. Terrell will speak on Society activities.

Cleveland—Dinner meeting at the Cleveland Engineering Society, December 19, at 6:30 p.m. Program starts at 8 p.m.

Colorado—Annual dinner meeting at the Denver Athletic Club Denver, December 8, at 6:30 p.m. Technicolor movie on "Steel—Man's Servant."

Florida—Dinner Meeting at the Seminole Hotel, Jacksonville, December 11, at 7 p.m. This will be Ladies Night and Past-Presidents Night.

Georgia—Annual meeting at Wooding's Cafeteria, Atlanta, December 6, at 1 p.m. ASCE President E. M. Hastings will speak.

Illinois—Annual luncheon meeting at the Engineers Club, Chicago, December 12, at 12:15 p.m.

Maryland—Annual meeting at the Engineers' Club, Baltimore, December 10, at 8 p.m. Meeting preceded by cocktails at 6 p.m., and dinner at 7 p.m.

Metropolitan—Meeting in the Engineering Societies Building, New York, December 17, at 8. p.m.

Mid-Missouri—Meeting at the University of Missouri, Columbia, December 6, at 7:30 p.m. Technical program to be put on by Student Chapter members.

Mid-South—Annual meeting in Jackson, Miss., December 5 and 6. Program features addresses by L. J. Sverdrup, consulting engineer, St. Louis, Mo., at the luncheon on December 5, and by the Hon. Tom Q. Ellis, clerk of the Mississippi Supreme Court, at the annual banquet that night.

Northwestern—Annual meeting at the Minnesota Union, University of Minnesota, December 1, at 6:30 p.m.

Philadelphia—Joint meeting with the ASME on December 9. Dinner at the Engineers' Club at 6 p.m.; meeting at the Philadelphia Electric, 9th and Sansom, at 7:30 p.m. E. C. Gegenheimer, of the Pennsylvania Railroad, will speak on "The Future of Railroad Transportation."

Puerto Rico—Annual meeting and dinner dance at the Condado Hotel, San Juan, December 12.

Sacramento—Meetings at the Elks Club every Tuesday at noon. No meetings on holidays; special meetings as announced in the "Engineerogram."

San Diego—Dinner meeting at the Tops Restaurant, San Diego, December 16, at 6:30 p.m. ASCE Director J. H. Gardiner and nominee for Director Julian Hinds will be present.

San Francisco—Annual dinner meeting at the Engineers' Club of San Francisco, December 16, at 6 p.m.

Tennessee Valley—Meeting of the Holston Sub-Section at the Franklin Club, Elizabethton, Tenn., December 17, at 6:30 p.m. Family night with Christmas tree and presents for the children.

Texas—Luncheon meeting of the Dallas Branch at the Adolphus Hotel, Dallas, January 5, at 12:15 p.m.

Scheduled ASCE Meetings

ANNUAL MEETING

New York, N.Y., January 21–23
(Board of Direction meets January 19–20)

SPRING MEETING

Pittsburgh, Pa., April 7–9
(Board of Direction meets April 5–6)

Recent Activities

AKRON

PROBLEMS FACING Akron in the treatment and disposal of its sewage were discussed by Frank C. Tolles, former Society Director, at the first meeting of the season. Mr. Tolles is a member of the Cleveland consulting firm of Havens & Emerson, which is designing an enlargement of the Akron sewage-treatment plant. The attendance of 47 included a number of members of the University of Akron Student Chapter. Officers of the Akron Section, which was organized in May 1947 are: Wendell R. LaDue, president; Sherman T. Swigart, vice-president; and Boris W. Boguslavsky, secretary-treasurer.

ALABAMA

ASCE Executive Secretary William N. Carey was guest of the Section for an all-day joint meeting with the University of Alabama and Alabama Polytechnic Insti-

tute Student Chapters, which was attended by 200. The meeting took place on the campus of the University of Alabama, which opened its laboratories for inspection and demonstrations. There were also inspection trips to several local industries, including the Goodrich Rubber Plant and the Hunt Oil Refinery. A talk on "Gasification of Coal Mines," by Milton H. Fies, director of mining operations for the Alabama Power Co., featured the afternoon technical program, and a panel of students from the two Chapters spoke on current engineering topics. Colonel Carey was the principal speaker at the evening dinner meeting, discussing the subject of "Leadership and the Engineering Profession."

CENTRAL OHIO

DEVELOPMENT AND fabrication of the Grasse River Bridge were discussed at a dinner meeting by B. J. Fletcher of the Aluminum Company of America. Various stages in the process of fabricating the 100-ft aluminum plate girder span were shown by means of slides. The speaker also described the processes used in rolling structural shapes and answered questions from the floor on the construction uses of aluminum.

CINCINNATI

CINCINNATI'S PROJECTED sewage-disposal program was described at a recent meeting by A. B. Backherms, principal engineer in charge of sewers and sewage disposal for the city. The speaker explained the methods to be used in financing the construction, maintenance and operation of the system, and showed how it will be coordinated with existing disposal systems in neighboring communities.

CONNECTICUT

YALE UNIVERSITY Student Chapter members attended a recent meeting in New Haven and heard Fred Lavis, New York consultant, speak on opportunities for American engineers in South America. Mr. Lavis, who has a background of years of engineering experience in South America, advised students interested in obtaining employment in Latin America to get in touch with American firms having contracts there instead of going to the foreign countries themselves to get jobs.

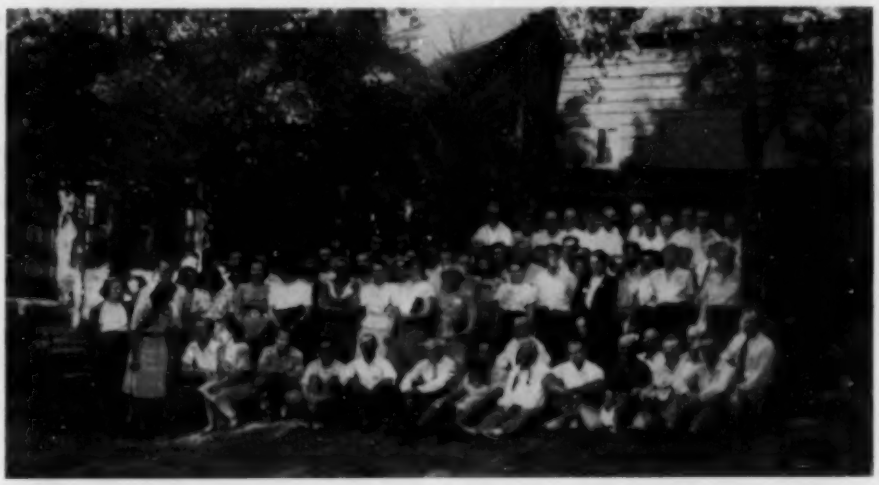
DULUTH

PROBABLE FUTURE trends in suspension bridge design were discussed at a recent meeting, following a review by S. B. Shepard of a paper on the subject by William Grove, bridge engineer for the State of Connecticut. There was also considerable general discussion of the proposed changes in ASCE membership grades.

KANSAS CITY

CONSTRUCTION OF THE Mississippi River bridge at Dubuque, Iowa, was discussed at a recent dinner meeting by a group of engineers on the staff of the Kansas City consulting firm of Howard, Needles, Tammen & Bergendoff. A. D. Kaufman gave an overall picture of the work; James Bucher described the surveying methods used and discussed the sinking of the foundations; and Norman Halfpap described the erection of the superstructure, illustrating his talk by slides. The program was arranged by the Junior Activities Committee, headed by W. G. Riddle, and all the speakers were Juniors.

A special event of the fall season was a Section picnic at the country home of J. C. Nichols in Johnson County, Kansas. Following the picnic dinner in the evening, Ernest E. Howard, former ASCE Vice-President, and C. A. Haskins, Kansas City consultant, sang duets.



MEMBERS OF KANSAS CITY SECTION and their families enjoy autumn picnic at home of J. C. Nichols in Johnson County, Kansas. Games and sports were order of day, followed by picnic dinner in evening.

COLORADO

A PANEL OF engineers from the U.S. Bureau of Reclamation presented the technical program at a meeting of the Section and the Technical Club of the Bureau of Reclamation. These included Herbert S. Riesbol, engineer in the Hydrology Division of the Branch of Project Planning, who read a paper on "Policies and Procedures for Determining Spillway Design Floods," and Clarence Rawhouser, head of the temperature control and related studies section of the Dam Engineering Division, whose subject was "Uplift Pressures on Concrete Dams." Inspection of the Bureau's experimental and research laboratories preceded dinner and the technical program. Staff engineers explained the experiments in progress, emphasizing the fact that all laboratory research work has a direct and important bearing on the design of Bureau projects.

GEORGIA

A CAPACITY CROWD attended the November 4 luncheon meeting and heard Frederick H. McDonald, consulting engineer of Charleston, S.C., analyze the recent survey sponsored by EJC, entitled "The Engineer in Transition." A former Director of the Society, Mr. McDonald is at present director of the Community Research Institute and publisher of the quarterly magazine, *Dixie*.

HAWAII

VAST EXPANSION OF Hawaii's original postwar highway program is necessitated by the damaged condition of the present highway system and the abandonment of railroads on the islands of Oahu and Hawaii, R. M. Belt, territorial superintendent of public works, told the members of the Hawaii Section at their November meeting. The present damaged condition of territorial highways was caused by heavy military traffic during the war and by the tidal wave of 1946. According to Mr. Belt, projected improvements will involve many unusual construction problems.

KENTUCKY

INSPECTION OF Wolf Creek Dam on the Cumberland River, near Jamestown, Ky., featured a recent Section meeting. Following a conducted tour of the project, the group visited the testing laboratory at the construction site. Started in 1940 and interrupted by the war in 1943, the Wolf Creek Dam project was reopened this year. Operations have reached the grading and concreting stage, and completion is expected by 1950. At the close

of the trip, the group met at the Lawrence Hotel in Jamestown for dinner and a technical program on the project. Speakers were J. I. Bowman and Louis Campbell, of the Nashville district office of the U.S. Engineer Department.

ILLINOIS

ENGINEERING ACHIEVEMENTS in the building of the Alaskan Highway were reviewed by Ralph S. Johansen at the first fall meeting of the Juniors of the Illinois Section. Mr. Johansen, who is a member of the Junior group, served as a major in the Army Corps of Engineers on the construction of the highway.

LOS ANGELES

PROS AND CONS in the current controversy between California and Arizona over water rights to the Colorado River were presented at a recent meeting in the form of a symposium on "Who Owns the Colorado River?" Principal speakers were the Hon. Gordon L. McDonough, Representative in Congress from California District No. 15 and member of the House Public Works Committee; Raymond Matthew, chief engineer of the Colorado River Board of California; and Preston Hotchkis, president of the Colorado River Association.

As a background for the program, the Junior Forum meeting, which preceded the main meeting, discussed the Los Angeles city water supply, reviewing the Owens Valley and Colorado River Aqueduct installations.

MARYLAND

MEMBERS OF THE engineering profession must apply their training and their abilities to problems outside the purely technical field, ASCE President E. M. Hastings told members of the Maryland Section at a recent dinner meeting. Emphasizing the need for better thinking in public life, Mr. Hastings asked why any engineer should not consider himself better qualified than the average politician as a leader in the life of his community and the nation. Guests of the Section for the occasion included Rear Admiral J. F. Jelley, assistant chief of the Bureau of Yards and Docks, and Maj. Gen. C. R. Moore, director of the Baltimore Department of Aviation.

METROPOLITAN

AT THE FIRST meeting of the fall season, Edward S. Sheiry, former head of the civil engineering department at Robert College, Istanbul, Turkey, introduced the technicolor film, "Outposts of American Education." The film, which covers the story of American colleges in Greece, Turkey, Syria, Lebanon, and Iraq, is narrated by Lowell Thomas. There was an attendance of about 300.

Insurance on construction work was discussed by B. A. Frey, special risk underwriter for the Indemnity Insurance Co. of North America, at a recent meeting of the Junior Branch. Mr. Frey outlined the method of setting premiums on short notice for construction bids and stressed the necessity for the contractor's requiring insurance from the subcontractor. In the question-and-answer period, the speaker explained how the engineer is affected by construction insurance.

MIAMI

A RECENT MEETING was devoted to discussion of the revision of the Section constitution and by-laws, and to the proposed changes in ASCE membership grades. At another meeting O. P. Hart, assistant city manager of Miami, spoke on the civic and industrial development of the city, advancing reasons for the continuing growth of the southeastern part of the state.

MID-SOUTH

A LARGE REGISTRATION of students—from the Chapters at the University of Mississippi, Mississippi State College, and the University of Arkansas—swelled the attendance at a recent all-day meeting of the Section, in Memphis, Tenn. A talk on municipal engineering in Memphis, by W. B. Fowler, city engineer, featured the technical program. There were also papers by three Student Chapter members—R. M. Williams, of the University of Mississippi; Whitney B. Jones, of Mississippi State College; and John N. Strange, of the University of Arkansas. The luncheon meeting was addressed by Dr. P. N. Rhodes, vice-president of Southwestern University at Memphis, who spoke on "Invention in America."

NASHVILLE

MOVABLE BRIDGES were discussed at the November 4 meeting of the Nashville Section by Leonard O. Hopkins, chief engineer of the Nashville Bridge Co. Donald A. DuPlantier, Section delegate to the Fall Meeting at Jacksonville, then reported the meeting to the membership. A number of Vanderbilt University Student Chapter members were guests of the Section for the occasion.

NORTHWESTERN

ALL THE ENGINEERING organizations in the Twin Cities met with the Northwestern Section in conjunction with its November 3 dinner meeting. Carl T. Nordstrom, president of the Twin City chapter of the Society of American Military Engineers, was in the chair, and ASCE Executive Secretary William N. Carey introduced the presidents of the various engineering organizations represented. The first speaker on the technical program was Col. Clark Kittrell, division engineer for the U.S. Engineer Office at St. Louis, who described the functions and operation of the Engineer Office in charge of engineering projects on the Upper Mississippi. He was followed by Maj. Gen. Edwin P. Parker, Jr., of the 5th Army Headquarters at Chicago, who discussed the present status of our occupation of Germany. General Parker recently returned from Germany, where he has been inspector general of our occupation forces. There was an attendance of about 200.

NORTHEASTERN

PARICUTIN VOLCANO in Mexico was the subject of an illustrated lecture, given by Dr. Preston E. Cloud, of Harvard University, at a joint meeting of the Section and the Boston Society Civil Engineers. An open house, to which engineering students in the New England colleges were invited, preceded the dinner meeting.

OKLAHOMA

CONSTRUCTION OF the foundations of the Hales Bar Dam project was described at a recent luncheon meeting by Frederick J. Smith, of the Sinclair Prairie Oil Co. Part of the meeting was devoted to discussing the Section's proposed new constitution and by-laws.

OREGON

ASCE PAST-PRESIDENT J. C. Stevens attended a recent dinner meeting and reported on the Fall Meeting at Jacksonville. Mr. Stevens also discussed current activities of the Board of Direction, commenting particularly on the present need of the Society for additional operating funds. A talk by Judge Walter L. Tooze on "The Relation of the Engineer to the Courts" comprised the technical program for the occasion.

PANAMA

A TOUR OF the materials testing laboratory at Miraflores Locks, where extensive corrosion tests are being made on various metals and alloys under the varying conditions found in the Canal Zone, constituted a recent meeting. The corrosion studies were explained by James E. Reeve, of the Special Engineering Division of the Panama Canal, and H. W. Mundt, head of the testing laboratory. ASCE Director William M. Piatt, who has been visiting Panama, attended the meeting.

PHILADELPHIA

PRESENT-DAY trends in steel construction are only an acceleration of the trends of ten years ago, according to C. Earl Webb, chief engineer of the American Bridge Co., who addressed the first

meeting of the fall season. Probably the most outstanding development in the fabrication of structural steel is welding, the speaker stated. Other trends noted by Mr. Webb include improvements in methods of prefabrication and great advances in economy and production volume. The second speaker on the program was Gurney H. Dayett, assistant bridge engineer for the Baltimore & Ohio Railroad, who gave an illustrated lecture on the new Kanawha River bridge at Point Pleasant, W. Va.

PUERTO RICO

ZONING AND its first year of application in Puerto Rico were discussed at a recent meeting by Ciro Malatrassi, head of the board of appeals of the Puerto Rico Building Permit Office. A lively general discussion of the problems facing engineers as a result of the application of the zoning law followed Mr. Malatrassi's talk.

SACRAMENTO

THREE LOCALLY IMPORTANT controversial questions were discussed in an open forum by the Juniors of the Section on the annual Junior Day program. The questions posed were: (1) What does the Section think of the recent reported action of the Civil Engineers' License Board in permitting registration in certain cases without written test? (2) Should federal and state governments hire a portion of their work done by consultants? and (3) Should Sections, as such, participate more fully in the activities of their legislative committees? Guest speakers for other recent luncheon meetings were Anson Boyd, California state architect; Ralf Woolley, president of the Intermountain Section; and Leon Hostetter, senior engineer for the U.S. Bureau of Reclamation.

ST. LOUIS

HIGH LIGHTS OF the Fall Meeting at Jacksonville were reviewed by ASCE Director Harry F. Thomson at a joint meeting of the Section and the Washington University Student Chapter. Five-minute talks on summer engineering jobs were given by Charles Johnson and A. G. Farkas, Student Chapter members, and Lawrence P. Roth, a recent graduate, now with the Westlake Construction Co. The Chapter then showed a film on the building of the Golden Gate Bridge, obtained through the local office of the Bethlehem Steel Co. Inspection of the materials testing laboratory, where the use of adhesive, electrical strain gages was demonstrated, concluded the evening.

SAN DIEGO

STRENGTH AND weaknesses of the Engineers Registration Act of 1947 were discussed by ASCE Western Representative Walter E. Jessup at a recent meeting. President Ross Compton of the Los Angeles Section, who for several years was a member of the state-wide legislative committee on registration, also spoke briefly on the subject. During the evening, J. L. Muchemore, a Junior in the Section, reviewed achievements of the EJC and pointed out what could be done locally through such an organization.

SAN FRANCISCO

DESIGN CONSIDERATIONS IN the planning of the Trans-Arabian Pipe Line were outlined at a regular dinner meeting by S. P. Johnson, engineer for the Standard Oil Co. and consultant to the Trans-Arabian Pipe Line Co. Mr. Johnson also related his experiences as a member of the reconnaissance party that traversed the route of the line, illustrating his remarks with lantern slides.

SEATTLE

IN A TALK on the compaction of earth fills, given at a recent meeting, Prof. R. G. Hennes, of the University of Washington, emphasized the fact that the main purpose of compaction is to improve the shearing strength of soils. He described standard tests to determine density relations, and discussed stabilization by chemical means. The showing of a film on exploring for oil concluded the program.

SYRACUSE

PRACTICAL APPLICATIONS of soil mechanics to engineering design were discussed at a joint meeting of the Section and the Technology Club of Syracuse. The principal speaker appearing on the program was Earl F. Bennett, principal soils engineer for the state of New York. There was an attendance of approximately 100.

TEXAS

AT A LUNCHEON meeting of the Fort Worth Branch, J. B. Thomas, president of the Texas Electric Service Co., gave a talk on power consumption in Fort Worth and west Texas and described the steps being taken to handle the unusual power demand. Another recent speaker before the Fort Worth Branch was Thomas Shiels, of the Portland Cement Association, whose topics was soil-cement roads.

TOLEDO

NEW DEVELOPMENTS in the field of telephony were reviewed at a recent meeting by staff members of the Ohio Bell Telephone Co. The principal speakers were Harold G. Rice, district commercial service manager, and B. H. Brandt, engineer for the organization. Motion pictures, showing various phases in the development of the Bell Telephone System, completed the presentation.

TRI-CITY

INSPECTION OF the new $30,000,000 Alcoa rolling mill plant, now under construction at Bettendorf, Iowa, featured a recent meeting. Following a tour of the plant—conducted by Edward F. Maziarz and H. F. Robey—the group met for dinner at Davenport, Iowa. The technical program consisted of a talk on "Trends in Modern Bridge Design," by Frank Beinhauer, general superintendent and chief engineer for the Priester Construction Co., of Davenport, Iowa.

WEST VIRGINIA

ASCE DIRECTOR W. R. Glidden attended a dinner meeting, held at Beckley, W.Va., and spoke on the subject, "The Head Lamps of Experience Light the Road Ahead." During the evening, John B. Hoke was elected president for the coming year, and F. D. McEnteer, vice-president. Part of the meeting was devoted to discussion of Section business.

WISCONSIN

THE PROBLEM OF recession of groundwater levels in Wisconsin has been of pressing importance in recent years because of excessive demands made upon the water supply during the war, Dr. Frank C. Foley, of the U.S. Geological Survey, told the members at a recent meeting. Recognizing this problem, the legislature in 1945 appropriated funds for a thorough study of existing conditions. Dr. Foley, who heads the survey, discussed some of the interesting findings that have come to light in the year and a half of its existence.

STUDENT CHAPTER *Notes*

CASE INSTITUTE OF TECHNOLOGY

CLOSE COOPERATION and teamwork between the architect and the engineer are required on any job, F. E. Rinehart, of the Cleveland firm of Walker & Weeks, told the members of the Case Chapter at their first meeting of the new school year. Speaking in the capacity of an architect, Mr. Rinehart stated that the architect who does not recognize the indispensable part played by the engineer on structural projects is deluding himself, and cited instances in which costly mistakes have been avoided by the capable consulting engineers employed by his firm. Prof. George E. Barnes, head of the department of civil engineering and engineering mechanics, welcomed the group and wished them another successful

year of Student Chapter activity. New officers taking their posts for the coming year are: Carl Bacik, president; Kenneth Novak, vice-president; Dave Jenkins, secretary; Robert Barkley, treasurer; Gene Erb, reporter; and Robert Schade, chairman of the Student Chapter Activities Committee.

PRESIDENT OF THE Case Chapter, Carl Bacik (left), and Prof. G. E. Barnes (far right) greet F. E. Rinehart, of architectural firm of Walker & Weeks, who addressed first meeting of school year.

COOPER UNION

WITH THE ISSUANCE of Vol. 2, No. 1, of *The Cooper Survey*, the Cooper Union Chapter continues publication of its mimeographed biweekly begun last year. As in the past, the bulletin capably covers the news of the civil engineering department. The present editorial staff includes Eli A. Rubin, editor-in-chief; Lester Gabrilowitz, news editor; Ted Astor, feature editor; Gil Martin, sports editor; Gerald Gardner, art editor; John Hoffman, assistant feature editor; and Ruth Bowden, secretary.

MISSISSIPPI STATE COLLEGE

RELATIONSHIP BETWEEN the student and the older members of the ASCE was discussed by George S. Salter, Mid-Western Representative of the Society, at a recent well-attended meeting. Mr. Salter stressed the ideals and objectives of the Society and pointed out the advantages of membership in it. The Mississippi State College Chapter is planning to attend a number of Local Section meetings and inspection trips in the vicinity.

UNIVERSITY OF MISSISSIPPI

THERE WAS A record turnout of 55 students and their guests for the first meeting of the fall semester. Continuing his tour of Student Chapters in the South, ASCE Mid-Western Representative George S. Salter addressed the group on the relationship between the Society and the Student Chapter. Officers elected during the course of the evening were Edward Hamric, secretary, and George Howell, program chairman. William T. McNutt and Leroy J. Henry remain as president and vice-president for another year.

University of Florida Student Chapter's "Civil Gator" Reports Jacksonville Conference

A SPECIAL issue of *The Civil Gator*, mimeographed biweekly of the University of Florida Student Chapter, is devoted to the Jacksonville Student Conference, to which the Chapter was host during the ASCE Fall Meeting. In addition to covering the technical and social events of the all-day program, *The Civil Gator* did a competent job of interviewing student delegates and obtaining their opinions on Student Chapter and Society matters. *The Civil Gator's* thorough coverage of the Conference is indicated in the following items excerpted from that publication.

Student Chapter Problems Discussed

A talk on typical Student Chapter activities by Prof. G. Brooks Earnest, chairman of the ASCE Committee on Student Chapters, featured the morning technical session. The student delegates then reported on membership problems in their particular Chapters, and described the methods being used to solve these problems.

At noon the delegates were guests of the Florida Section and the ASCE Board of Direction at a joint luncheon at the Hotel Roosevelt, which was addressed by President E. M. Hastings.

Hydraulic Dredges Inspected

Following the luncheon meeting, special buses and tugs took the Student Chapter representatives to view the operations of the ladder-type rock dredge, "Corozal," off Commodores' Point. Inspection of a hydraulic dredge working off the Shell Oil Company's piers at Long Branch completed the inspection program. The trip was arranged by Harold A. Scott, of the U.S. Engineer Department, with the cooperation of the Arundel Co., of Baltimore, owners of the dredges and tugs.

Out-of-State Chapters Represented

A large delegation from The Citadel, at Charleston, S.C., was led by Ted Williams. With him were Charles W. Foster, Garrett Wilson, Keating L. Simons, Ben A. Hagood, Frank McCormick, and their Faculty Adviser, H. Gale Haynes. The University of Kentucky, at Lexington, Ky., was represented by John H. Clark, and the Speed Scientific School, at Louisville, by Ken Ohlman and Ralph Rommel.

Representatives of the Alabama Polytechnic Institute Chapter were Carlos Botts, Lewis Morgan, William T. Willis, Norman Liver, Edward Barrett, and Claude Roberts. Col. R. A. Marr, Faculty Adviser for the Virginia Military Institute, was accompanied by six cadets from that school: Matt Moyer, Student Chapter president; Peter Davies, George Wolfe, Judson Ellis, Stuart Loughborough, and Paul Fleming. The Clemson College delegation consisted of C. E. Williams, C. M. Trott, U. B. Caldwell, W. R. Gwinn, R. J. Rauch, and their Faculty Adviser, I. A. Trively.

Many Delegates Take to the Air

That this is, indeed, an air-minded age is attested by the fact that many of the delegates interviewed had flown to the conference. Two of these—Lawrence Sieck and Ellis B. Pickett, president and secretary of the Iowa State College Chapter—came from far-off Ames, Iowa, in a 12-hour flight. Morris Jones, delegate from Vanderbilt University, flew from Nashville, Tenn. Other air-minded representatives were William Young, Dan Miller, and Prof. Russell B. Maxey, of the University of South Carolina.

ELLIS PICKETT (left) and Larry Sieck, secretary and president of Iowa State College Student Chapter, Ames, Iowa, prepare to take off in latter's plane for Jacksonville Student Conference.

NEWS BRIEFS

Dedication Ceremonies Mark Completion of San Diego Aqueduct

AN IDEA THAT TOOK FORM soon after the turn of the century becomes a reality this month when Colorado River water is turned into the San Diego Aqueduct to provide an urgently needed supplemental supply for San Diego and adjacent communities (see description of aqueduct in July 1947 issue of CIVIL ENGINEERING).

Dedication of the 71.1-mile Navy-built aqueduct, which connects with the Metropolitan Water District of Southern California system in Riverside County, is set for December 11. High ranking officers of the Navy and other national and state figures have been invited to participate in the dedication and the attendant community celebration.

Delivery of Colorado River water will solve, temporarily, San Diego County's most pressing problem—that of an adequate supply to meet the demands of the vast Naval establishment in the area and at the same time serve the needs of industrial, agricultural and domestic consumers. The aqueduct will deliver 50,000,000 gal daily, with a like amount available when necessitated by community growth. In anticipation of this increased demand, the tunnels—seven in all—were constructed for maximum capacity. The additional supply would require only the building of a parallel pipeline.

Colorado River water diverted from the Metropolitan system will flow by gravity from San Jacinto tunnel to San Vicente Reservoir, newest and one of the largest storage basins in the city's impounding system. From there the water will be distributed to member agencies of the San Diego County Water Authority.

In addition to San Diego, these include Oceanside, National City, Chula Vista, Fallbrook Public Utility District, Lakeside Irrigation District, and the La Mesa, Lemon Grove and Spring Valley Irrigation District.

Following negotiations with the federal government, the City of San Diego contracted to purchase the aqueduct, and liquidate the $15,000,000 cost over a 30-year period.

COMPLETION OF ROUGH WORK on 3,800-ft San Vicente tunnel is witnessed by representatives of the City of San Diego, the Metropolitan Water District and the San Diego County Water Authority. View shows north portal of tunnel through which Colorado River water will flow into San Vicente Reservoir.

Estimated $21,000,000,000 of New Construction in 1950 Depends on Lowering of Costs

THERE IS PLENTY of work ahead of the construction industry with an estimated need for construction approaching $21,000,000,000 in 1950, but it is essential that costs come down, James W. Follin, M. ASCE, Assistant Administrator of the Federal Works Agency, told the Structural Engineers Association of California at a recent meeting in Yosemite.

Speaking on "Can the Construction Industry Fulfill the Nation's Requirements?" Mr. Follin said flatly that he "could not answer that question right now." He referred to the estimated $12,000,000,000 in new construction in the United States this year, second only to the top wartime construction of 1942, and commented that "actually, things are not as they seem."

"It is difficult to estimate the physical volume for 1947," he said, "because statistical data are not yet available, but wholesale prices of building materials have gone up considerably and so have wage rates. Because of these sizable increases in construction costs, I would guess that a round figure of $6,500,000,000 for this year in terms of 1939 prices would come pretty close to the final figures. Actually the physical volume of 1947 construction is probably less than the late 20's, not much over 1931, and about the same as in 1939 and 1940.

"To set the construction picture in another way, new construction activity averaged about 10½ percent of national income during the 20-year period from 1920 to 1939. It is now running but little more than half that rate given in terms of current dollars. Construction volume today is about the same as it was in 1930.

"Construction prices have risen faster than the prices of manufactured goods. The relation of income to construction costs should be a good indicator of ability to purchase the products of construction. We find that family income of non-farm families, in terms of current dollars, rose about 130 percent from 1915 to mid-1947, and we find that construction costs have risen 320 percent. It takes more out of the family income to pay for a house today than it took out of the family income in 1915.

"A greater volume of activity for the construction industry depends in large part on a lowering of costs, both in current dollars and in relation to income, to obtain a broadening of the market," Mr. Follin declared.

"We are confronted with a problem of decreasing construction costs through greater productivity," he said, "but we also need an

increase in the 'productivity of management,' the development of better methods and better technology.

"While prices, excluding the effects of a depression, may not go back to prewar, they could well level out at about 50 percent above prewar, some 20 to 30 points less than at present. This is a long-run level. It may not happen this year, or next year, but I do have hopes for the foreseeable future."

Modern Road Building Equipment Provides Better and More Economical Highways

BECAUSE OF INCREASED labor costs and shortage of materials, road builders are relying on mechanical equipment to provide better and more economical highways, Charles M. Upham, M. ASCE, engineer-director, American Road Builders' Association, told a group of road engineers in Washington recently. Pointing out the progress made before the war in the development of time- and labor-saving machinery, the speaker indicated that the cost of common excavation dropped from more than 40 cents a cubic yard in the days of hand labor and animal power to 34 cents at the beginning of the diesel era in 1928, and to 21 cents by 1940 through refinements in design of machinery.

In scraping operations, he said, two-horse wheelers before 1923 handled 2.85 yd an hour at a haul of 800 ft, and three $1^1/_2$-yd wheelers with a 60-hp tractor handled 22.4 yd in 1924–1928. In the final prewar stage, 1934–1940, 14-cu yd carry-type scrapers with 95-hp tractors moved 53 yd per hour with a 1,500-ft haul, while a 23-cu yd scraper, with 95-hp tractor and pusher, moved 68 yd per hour with a 2,000-ft haul. It will be observed that the scrapers of 1940 delivered 46 times as much earth at 800 ft as was moved prior to 1924. Furthermore the economic length of haul for scrapers increased from 600 ft to 2,500 ft.

"It must be remembered," said Mr. Upham, "that all these advances came before World War II. During the war years the pressing need for speed and efficiency in earthmoving and all phases of road building called for the highest ingenuity and scientific skill of equipment manufacturers. Out of the war has come highway construction machinery which is revolutionary in the prodigious tasks which it can accomplish."

A contributing factor to these improvements has been the work of the joint committee on construction equipment of the American Road Builders Association and the Highway Research Board.

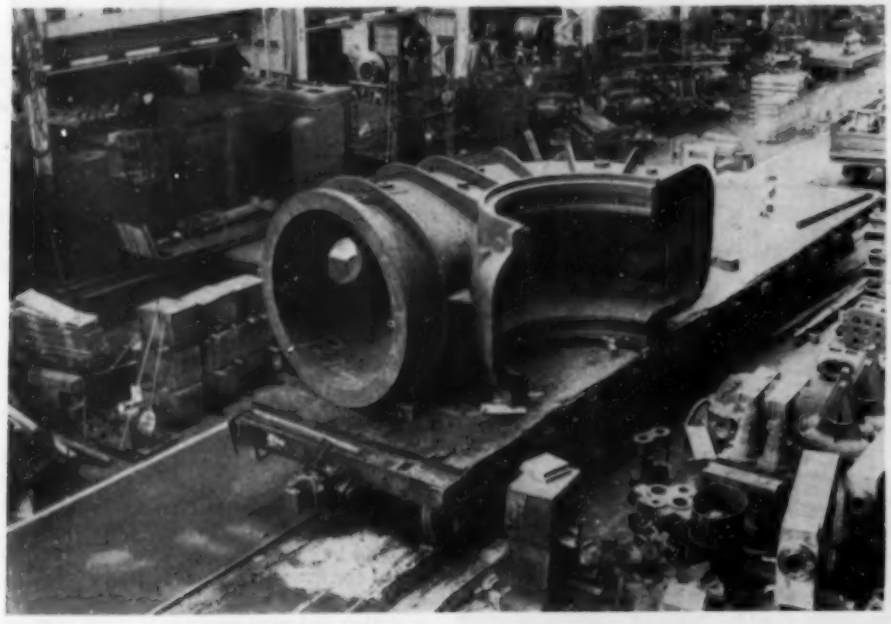
Arc Welding Foundation Announces Design Awards

AWARDS FOR PAPERS under 15 scientific and engineering classifications in arc welding, submitted by engineers, scientists, production personnel and method and maintenance engineers, were announced recently by the James F. Lincoln Arc Welding Foundation. The 476 awards included in the $200,000 "Design for Progress" program ranged from $100 to $13,200 for the main award.

Paul F. Hackethal, Clarence C. Mast and Douglas W. Hamilton of the Koppers Co., Baltimore, Md., were given the first main award of $13,200 as co-authors of a paper on the welded design of a variable-pitch propeller hub for light airplanes in relation to strength and manufacture. Kiser E. Dumbauld, design engineer, Bureau of Bridges, Ohio State Highway Department, received the second main award of $10,700 for his paper on redesign to welded construction of three of Ohio's bridges. A paper submitted in the Industrial Machinery division brought the third main award of $8,200 to G. J. Storatz, engineer-in-charge, Heil Co., Milwaukee, Wis.

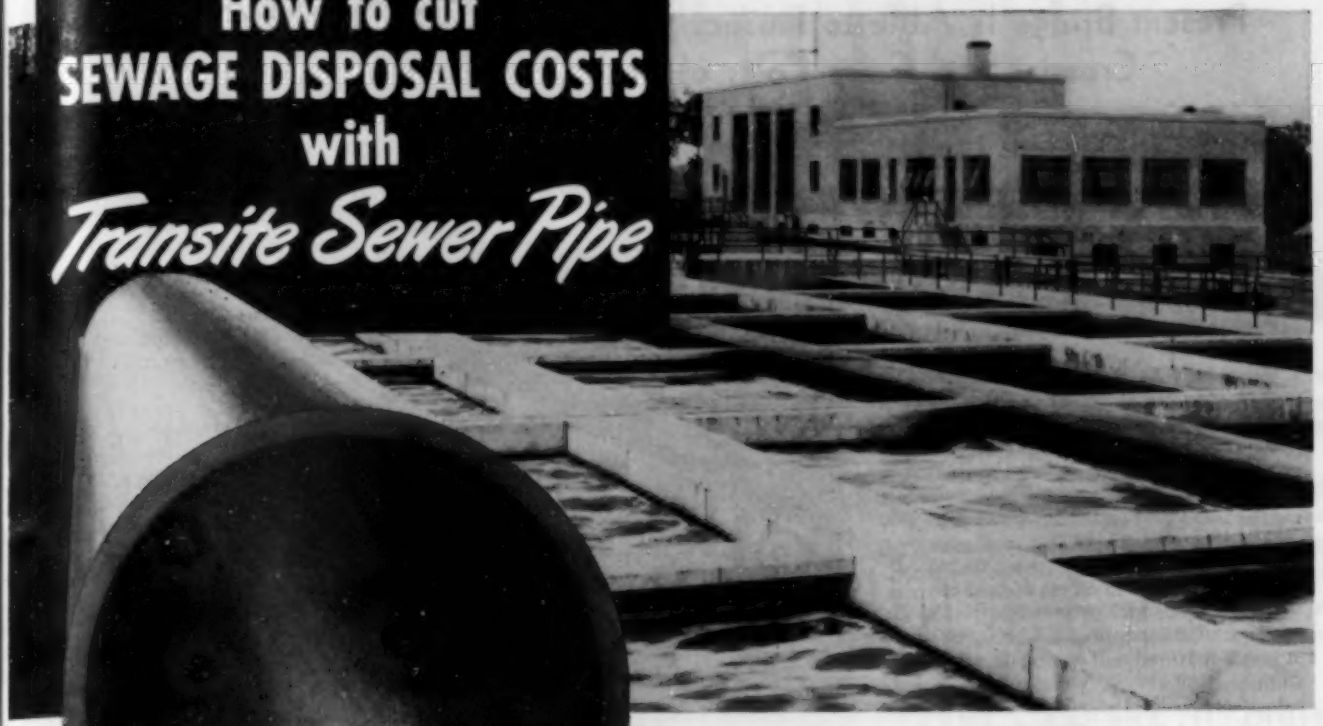
Five ASCE members were among the 22 jurors selected by the Foundation's trustees to make the awards: Edward L. Ashton, University of Iowa; James G. Clark, University of Illinois; F. W. Stubbs, Jr., Rhode Island State College; Harold E. Wessman, New York University; and Chilton A. Wright, Brooklyn Polytechnic Institute, Brooklyn, N.Y.

Large Pumps Will Handle Detroit's Storm Water



LARGER OF TWO SECTIONS OF CASING (left) for first of three vertical mixflo-type pumps, which will deliver total of 1,170 cfs against 35-ft static head when installed in City of Detroit's new Bluehill Storm Water Pumping Station, is pictured here in plant of Worthington Pump and Machinery Corp., Harrison, N.J. Model of pump, studied by group of Detroit officials (right), has 12-in.-dia discharge nozzle as compared with 72-in. measurement for prototype. Detroit officials (facing camera) are W. C. Rudd, mechanical engineer, Advance Planning Section; E. J. Jones, Commissioner of Public Works; and G. R. Thompson, M. ASCE, City Engineer. S. W. Kitson, manager, Worthington Public Works Division, at left, conducts model test.

How to cut SEWAGE DISPOSAL COSTS with *Transite Sewer Pipe*



Reduced Treatment Costs

Two features of Transite* Sewer Pipe present an opportunity for important savings in the treatment of sewage:

1. Sleeve-type joints that make up tight and stay tight in service.

2. Long 13-foot lengths that mean fewer joints in the finished line.

This double safeguard against infiltration—*tighter* joints as well as *fewer* joints—has the practical effect of reducing the load at the disposal plant ... often to the extent that overall treatment costs are substantially cut.

This reduction in sewage load also enables plant capacity to be conserved for future needs. And, where new treatment facilities are being planned, it permits consideration of a smaller plant . . . with possible economies in both buildings and equipment.

Transite offers other economies, too. Other important savings are possible with this pipe because it has an exceptionally smooth interior which offers minimum resistance to the flow of sewage. Its flow capacity is unusually high—n=.010. This often permits use of flatter grades and shallower trenches—with correspondingly lower excavation costs. Or, as an alternate economy, smaller diameter pipe may be used.

Low maintenance through the years. Made of asbestos and cement combined into a homogeneous material of great stability, Transite Sewer Pipe is corrosion-resistant. Tight joints safeguard against root trouble. And every Transite length is factory-tested for strength and uniformity. This adds up to low annual maintenance costs through the years.

For Further Information. If you are seeking ways to lower sewage disposal costs, send for the Transite Sewer Pipe brochure. Write Johns-Manville, Box 290, New York 16, N. Y., for your copy.

*Reg. U. S. Pat. Off.

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Transite Sewer Pipe

Present Bridge Is Able to Finance Second Bay Crossing and Carry Costs of Both

PRESENT REVENUES from the San Francisco-Oakland Bay Bridge can finance another parallel span estimated to cost $100,000,000 and carry its interest and bond redemption costs even if earnings do not increase in the future, according to a recent statement by C. H. Purcell, M. ASCE, director of California's Department of Public Works, as quoted in *California Highways and Public Works* for September–October 1947.

Financing could be accomplished by combining outstanding bonds of the present bridge with a new bond issue for a second similar structure, Mr. Purcell stated, basing his assertion on known and anticipated future traffic on the present bridge. During the fiscal year ended February 28, 1947, revenues totaled $7,981,000, and expenses, including bond maturities, were $3,248,341, leaving $4,732,659 in excess of fixed charges.

Bridge bonds now outstanding total $42,215,000. On September 1, $1,090,000 worth of bonds matured and were paid off, and an additional $2,417,000 worth of bonds were called and redeemed out of excess money now on hand, leaving $38,708,000 worth of bonds to be retired. All outstanding bonds are callable on March 1, 1950. The present span could become toll free early in 1953 if no second structure were contemplated.

Mr. Purcell stated that if the California Toll Bridge Authority desired to do so, it could safely, under a new revenue bond issue, sell enough bonds in 1949 to retire outstanding bonds of the existing bridge in 1950 and also finance a second bay crossing similar to the present one in design and location. An article on recommendations for a second San Francisco Bay bridge was published in CIVIL ENGINEERING, May 1947, page 22.

LARGE EARNINGS characterize heavily traveled San Francisco-Oakland Bay Bridge. In last fiscal year structure which cost $79,600,000 with approaches, earned $4,732,659 in excess of fixed charges, including bond maturities.

Hungry Horse Dam Project Planned for Completion in Five Years

CONSTRUCTION OF Hungry Horse Dam, to start in the spring, will involve the placing of approximately 2,760,000 cu yd of concrete in an arch gravity structure 520 ft high above foundation and about 2,000 ft long, according to a recent Bureau of Reclamation statement. The dam, on the South Fork of the Flathead River, about 30 miles northeast of Kalispell, Mont., will be the fifth highest in the world.

The reservoir created by the dam will have a capacity of 3,500,000 acre-ft for irrigation near Kalispell, to produce hydroelectric power for the Northwest, and to control damaging floods. The reservoir will also serve to increase the firm power capacities of existing power plants on the Colorado River.

Soon to be placed under construction is a tunnel to divert the waters of the river during construction of the dam. Bids for this work were opened on October 15. About 45,000 cu yd of material will be excavated to form a horseshoe-shaped tunnel 36 ft in diameter and about 1,100 ft long. An additional 32,000 cu yd of material is to be excavated in the open cuts at the tunnel portals. The contractor is allowed 250 calendar days for completion of this work.

Appurtenant works included in the dam project are a concrete-lined, radial-gate-controlled, open-channel spillway on the right abutment and a power plant of 300,000-kw capacity at the downstream toe of the dam. Bid calls for the dam are expected to be issued early in 1948, with completion scheduled in approximately five years.

The principal items of work included in the project and approximate quantities are as follows:

700,000 cu yd of stripping for aggregate deposits
50,000 cu yd of excavation, common, for dam and powerplant
600,000 cu yd of excavation, rock, for dam and powerplant
315,000 cu yd of excavation, all classes, for spillway
110,000 lin ft of foundation grouting and drainage holes
120,000 lb of metal pipe and fittings for foundation grouting and drainage, to be furnished and placed
2,760,000 cu yd of concrete in dam
76,000 cu yd of concrete in powerhouse
11,000 cu yd of concrete in spillway
15,000 cu yd of reinforced concrete in miscellaneous structures, including trashrack structures, elevator and utility towers, sidewalks and parapets, upstream portal of diversion tunnel, and outlet-works valve house
25,000 cu yd of non-reinforced concrete in miscellaneous structures, including diversion tunnel plug and gravity retaining walls
16,000,000 lb of reinforcement bars, to be furnished and placed
60,000 lin ft of metal sealing strips, to be furnished and placed
3,200,000 lb of metal tubing and fittings for concrete cooling system, to be placed
240,000 lb of metal tubing and fittings for grouting contraction joints, to be placed
6,000,000 lb of penstock and outlet pipes, to be installed
1,720,000 lb of gates and valves, including radial gates, diversion-tunnel gate, fixed-wheel gates for penstocks; bulkhead gate, ring-follower gates, and hollow-jet valves for outlet pipe; to be installed
1,300,000 lb of gate frames and guides for penstocks, outlet works, and diversion tunnel gates, to be installed
410,000 lb of gate hoists for penstock gates, radial gates, and diversion tunnel gate, to be installed
1,330,000 lb of trashrack metalwork, to be installed
2,025,000 lb of traveling and gantry cranes, to be installed
700,000 lb of structural steel in powerplant, to be installed
600,000 lb of miscellaneous metalwork, including stairways, floor plates, miscellaneous piping, and gantry-crane rail, to be installed

MAP OF MONTANA shows site of Hungry Horse Dam, for which bids are to be let early in 1948 with completion planned for 1953. Structure 520 ft high above foundation and about 2,000 ft long, will back up reservoir of 3½ million acre-ft, to accomplish multiple purposes of irrigation, power, and flood control.

FINISHING A SLOPE . . . without leaving tire marks

BUILDING A ROAD . . . moving a tremendous windrow.

MIXING BLACKTOP . . . all wheels miss the windrow.

RIDING A LONG SLOPE . . . All-Wheel Steer holds both ends steady.

CLEANING A WET DITCH . . . keeping rear truck on road.

"99-H"

Built to Outperform

No Motor Grader without All-Wheel Drive and All-Wheel Steer can hope to equal the all-around operating efficiency of the Austin-Western "99-H" Power Grader, with its High-Lift Blade, Extreme Blade Reach and Completely Reversible Blade.

On the "99-H" there are no idling front wheels—no dead front end to consume power and decrease operating efficiency. The entire weight of the machine is on the driving wheels—front and rear—contributing 100% to traction, and getting the most out of the 13-foot blade.

All-Wheel Steer provides unequalled maneuverability; saves time on every job; makes it possible to work in places where ordinary motor graders cannot go—do things they cannot do.

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SLOPING A BANK . . . using high-lift blade.

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Corps of Engineers Asks Bids on Buggs Island Dam

BIDS WERE INVITED recently by the District Engineer Office, Corps of Engineers, at Fort Norfolk, Va., for construction of a concrete gravity dam across the Roanoke River at Buggs Island, Mecklenburg County, Va., 20.3 miles below Clarksville and about 16 miles southwest of South Hill. Construction of the dam only—a structure of 2,800-ft total length and maximum height of 144 ft—and installation of its appurtenant facilities are included in this particular contract.

Equipment for operating the dam, consisting of ten sluices 5 ft 8 in. by 10 ft, 22 Tainter gates 42 × 32 ft, nine welded steel plate penstocks, six of which are 24 ft in diameter, and six caterpillar-type intake gates, will be supplied by the government.

The contractor will furnish all materials and perform or install the following major items of work:

(*a*) Cofferdams for river control including their construction and removal. (First-stage cofferdam, including 2,100 tons of steel sheetpiling, is now in place.)

(*b*) 200,000 cu yd of earth and rock excavation.

(*c*) 300,000 sq ft of foundation preparation.

(*d*) 30,000 lin ft of drilling for curtain grouting and drain holes.

(*e*) 600,000 cu yd of concrete.

(*f*) 500,000 bbl of cement.

(*g*) 825 tons of structural steel and miscellaneous steel and iron.

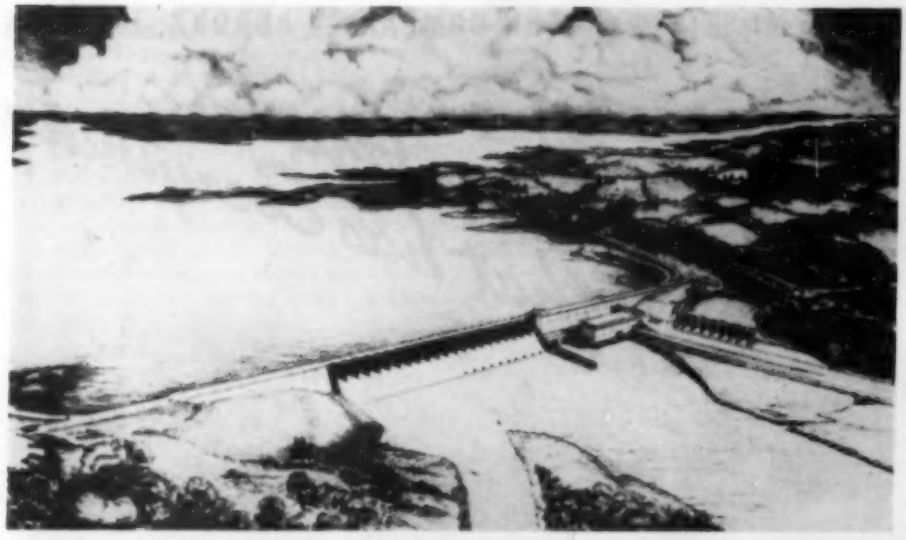
(*h*) 2,800 tons of reinforcing steel.

(*i*) 770 tons of welded steel penstocks, six of which are 24 ft in diameter.

(*j*) Mechanical equipment and systems consisting of emergency gasoline electric generator, heating and ventilating system, compressed-air system, plumbing, drainage, raw-water supply, and miscellaneous piping.

(*k*) Electrical equipment and systems consisting of conduit, wire and cable for power, control, and lighting.

Bids are expected to be opened on January 13, 1948.



CONCRETE GRAVITY DAM is largest part of $57,730,000 Buggs Island power and flood control project on Roanoke River near Boydton, Va. Dam will be 2,800 ft long with maximum height of 144 ft. Work is scheduled to be completed in 1,185 days after notice to proceed.

New Approach Suggested for Studying Geometrical Bodies

IN A PAPER read before a recent meeting of the American Mathematical Society, Prof. C. B. Allendoerfer of Haverford College stressed the importance of studying the properties of surfaces and other geometrical bodies of higher dimension as a whole instead of studying their properties in a small local region. The paper was titled, "Global Theorems in Riemannian Geometry." This shift in emphasis may be compared to the current shift in politics from the problems of a single nation to those of the world as a whole.

Professor Allendoerfer pointed out that geometers in the past have studied the local properties of space in a branch known as "differential geometry" and have also studied the properties of space as a whole in a branch known as "topology." It is now possible to relate these two fields by showing the influence of local properties upon the character of the whole space. In the political analog this would mean that one would study the effects of a form of government in a single nation upon the political problems of the whole world.

One of the major connections of this type so far developed relates the curvature of a space (a local property) with an integer known as the Euler-Poincare Characteristic of the space which describes one of its chief properties as a whole. For a sphere this integer is two, and for a torus (a doughnut-shaped surface) this integer is zero. From this theory it follows that the average curvature of a sphere is different from zero, but that the average curvature of a doughnut is zero. The study of questions of this sort has led to new developments in the theory of the curvature of spaces and raises numerous unsolved problems in the field of typology.

Engineers Needed!

To keep Western reclamation work rolling at the pace prescribed by the Congress, the Bureau of Reclamation needs more engineers.

Men who are trained and experienced in the design of dams, irrigation canals, power plants, transmission lines and equipment, roads, railroads, bridges, steel and concrete structures and drainage works, are urged by the Bureau to submit applications for federal employment (Form 57) to the Chief, Personnel Field Office, Bureau of Reclamation, Denver Federal Center, Denver, Colo.

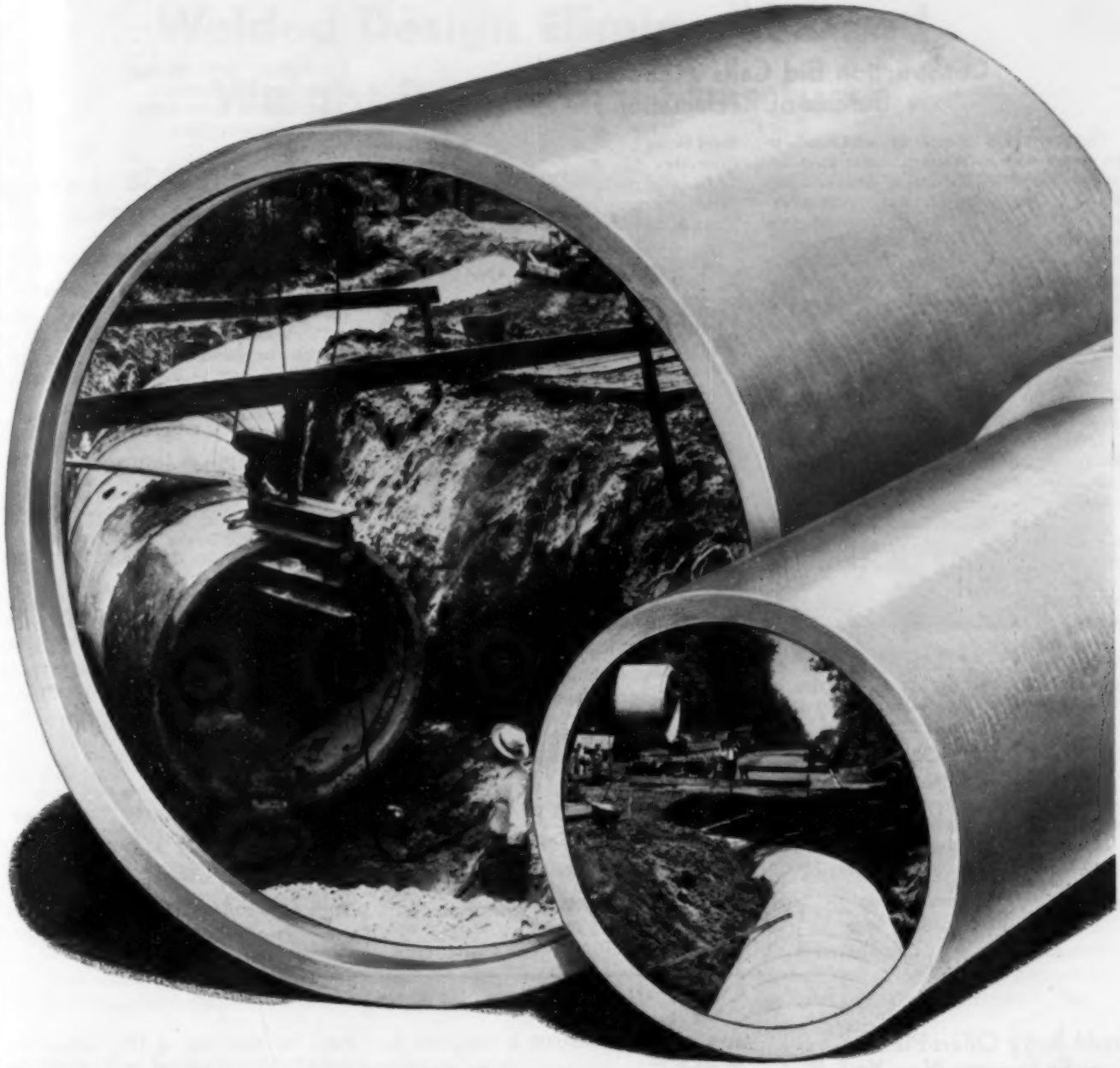
Engineers are needed in the office of the Chief Engineer in Denver and in 29 field design offices throughout the 17 Western states. Chief Engineer Walker R. Young states that through the facilities of the Branch of Design and Construction at Denver he can offer young engineers an opportunity to learn the principles and practices of reclamation engineering and a chance for a worth-while career in the federal government. These engineering positions pay from $2,644.80 to $4,149.60 to start.

Throughout the Missouri River basin, field engineers are needed. Thirteen new dams are now being started, 4 others are under construction. On these projects, located in the states of Montana, Wyoming, North Dakota, South Dakota, Colorado, Nebraska, and Kansas, field engineers can apply their theory and knowledge to actual construction. The work is hard and the living conditions for families are temporary in some cases, but there is opportunity for engineers to get the practical experience they need in order to qualify for future promotion.

Those desiring to work on the Missouri River basin project should send their applications directly to the Regional Director, Region 6, Billings, Mont., and to the Regional Director, Region 7, Customhouse, Denver, Colo.

Engineers who possess civil service status and are eligible for reinstatement may be given permanent appointments. Those who are presently employed by the federal government may be transferred at government expense, provided the transfer is not for the convenience of the employee. Those who do not possess civil service status should apply to the Central Board of U.S. Civil Service Examiners, Bureau of Reclamation, Denver Federal Center, Denver, Colo., for information concerning civil service examinations. At the present time, temporary appointments pending establishment of civil service registers, are being given to engineers who subsequently will have to pass civil service examinations.

Briefed from Reclamation Era, November 1947.



Richmond, Va. Builds New Storm Sewer with CONCRETE PIPE

THE NUISANCE and traffic hazards that resulted from excessive surface drainage in the 270-acre Westover Hills-Forest Hill Terrace area of Richmond, Va. are being corrected with a new storm sewerage system made of concrete pipe. In all, 13 sizes of pipe are used in this project—ranging from 12″ to 24″—ASTM C14-41 plain concrete pipe and from 27″ to 84″—ASTM C75-41 reinforced concrete pipe.

Concrete pipe lines give safe, strong, durable, and economical service for sewerage, drainage and water lines. Concrete pipe provides maximum hydraulic capacity. Tight joints and uniformly dense concrete insure minimum infiltration and leakage. First cost is moderate and the many years of service result in ***low annual cost.***

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The Westover Hills-Forest Hill Terrace project was designed by the City of Richmond and directed by Gamble M. Bowers, Director of Public Works, and supervised by E. L. Clements, Chief of the Bureau of Sewers and Structures, Department of Public Works. Photos, courtesy Richmond Department of Public Works.

AMERICAN CONCRETE PIPE ASSOCIATION

228 NORTH LASALLE STREET, CHICAGO 1, ILLINOIS

Construction Bid Calls Announced by Bureau of Reclamation

CONSTRUCTION PROJECTS scheduled to get under way in Western states soon are announced in the Bureau of Reclamation's *Advance Construction Bulletin* for November 1. Bid calls listed are for information only, the *Bulletin* states, and are subject to revision. Further information on these projects may be obtained from the Chief Engineer, Bureau of Reclamation, Denver 2, Colo., or the nearest regional director.

EARTHFILL DAM

Medicine Creek Dam, Missouri Basin Project

Location: 2 miles north, 7 miles west, of Cambridge, Nebr.

Work: Construction of an earthfill dam approximately 107 ft high and 3,600 ft long; and construction of 7.5 miles of gravel-surfaced access road.

Excavation	1,450,000 cu yd
Earthfill	3,200,000 cu yd
Concrete	33,000 cu yd
Steel gates	940,000 lb
Furnish and place corrugated metal pipe	1,600 ft
Cement	64,000 bbl
Steel pipe	67,000 lb
Time Allowed for Completion:	1,400 days.

PIPELINE AND STORAGE TANKS

Boulder Canyon Project, Nevada

Location: Boulder City, Nev.

Work: Furnishing and installing six miles of 12- and 14-in.-dia high-pressure steel pipe and erection of one 50,000 and one 2,000,000-gal storage tank.

Excavation	39,000 cu yd
Steel tanks	800,000 lb
Concrete	40 cu yd
12-In. steel pipe	265,000 lb
14-In. steel pipe	1,510,000 lb
Time Allowed for Completion:	270 days.

TUNNEL AND CANAL

Riverton Project, Wyoming

Location: At the confluence of the Wind and Big Horn Rivers near Pavillion, Wyo.

Work: Construction of Muddy Ridge Tunnel, approximately 2,870 ft long; about 2,000 ft of Wyoming Canal and extensions; about 2,000 ft of lateral.

Excavation	113,900 cu yd
Concrete	3,400 cu yd
Furnishing and placing steel tunnel supports	190,000 lb
Furnishing and placing reinforcement steel	188,000 lb
Timber lagging	113 Mb. m.

CONCRETE PIPES

Central Valley Project, California

Location: Vicinity of Tracy, Calif.

Work: Construction of three 15-ft-dia concrete discharge pipes. Approximate combined length, 8,600 ft.

Time Allowed for Completion: 500 days.

PUMPING PLANT

Klamath Project, Oregon-California

Location: Near Merrill, Ore.

Work: Construction of Adams 60-cfs pumping plant with wooden superstructure.

Furnishing and placing reinforcement steel	52,000 lb
Miscellaneous metal work	3,000 lb
Install pumping units	18,000 lb
Excavation	3,300 cu yd
Furnishing and placing trash-rack structures	9,000 lb
Time Allowed for Completion:	180 days.

SURGE TANKS

Central Valley Project, California

Location: Tracy Pumping Plant, near Tracy, Calif.

Work: Furnishing and erecting three 30-ft-dia steel surge tanks. Approximate combined weight, 1,800,000 lb.

Time Allowed for Completion: 500 days.

PUMP HOUSE

Boulder Canyon Project, Nevada

Location: Vicinity of Boulder City, Nev.

Work: Construction of 22 × 25-ft reinforced concrete pump house.

Excavation	1,350 cu yd
Reinforcement steel	39,000 lb
Concrete	235 cu yd
Time Allowed for Completion:	180 days.

LATERALS

Minidoka Project, Idaho

Location: North of Eden, Idaho.

Work: Construction of earthwork and structures for lateral 27.2.

Excavation	8,600 cu yd
Pneumatically applied mortar	2,000 cwt
Concrete	57 cu yd
Time Allowed for Completion:	150 days.

Trade Body Offers Plan To Improve New York Piers

EARLY IMPROVEMENT of New York City's waterfront through complete rebuilding or extensive repair of many of its dilapidated and outmoded piers is recommended in a report just published by the World Trade Corporation, an organization created in 1946 by the New York State legislature to study the city's water-traffic facilities and undertake their improvement.

Total cost of all construction and repairs in this long-range program is estimated at $250,000,000, of which $71,000,000 would be paid to the city for a 40-year lease of city-owned waterfront properties, $89,000,000 would be expended on the initial phase of construction, and $60,000,000 on the long-planned Washington Street market project, the two latter projects to proceed simultaneously within a period of three to five years. Of the $30,000,000 remaining, $25,000,000 would be invested in government bonds, leaving $5,000,000 available for working capital. Acquisition and development of privately owned waterfont facilities constituting the second stage of the project at a cost of $70,000,000 is postponed for future study.

Building of marginal wharves instead of finger piers at certain points along the Hudson River with car-float bridges and rail connections is suggested by the survey engineers, Sanderson and Porter, New York, to reduce turn-around time, handling costs and delivery delays. Under the Washington Street Market project, six piers are to be rebuilt, accommodating part of the produce hall which will extend beyond the water line.

AGC Will Sponsor 100 Units in Organized Reserve Corps

SPONSORSHIP OF 100 affiliated units in the Organized Reserve Corps by the Associated General Contractors of America was announced recently by Lt. Gen. R. A. Wheeler, Chief of Engineers. In assigning the units to the AGC, the first to be allotted by the Corps of Engineers, General Wheeler said: "Our state of preparedness depends upon the success of this plan. The 100 construction units which you propose to sponsor form the backbone of the Engineer program." Wholehearted endorsement has been given to the plan by the governing and advisory boards of the AGC.

Reserve construction units needed by the Army in its affiliation program are sponsored by civilian organizations with functions closely allied to the military purpose of the unit. The units to be sponsored by AGC—the ultimate strength of which will be 45,000 officers and men—include construction battalions, aviation engineer battalions, headquarters and headquarters companies of engineer construction groups, headquarters and headquarters companies of aviation engineer groups and headquarters and headquarters companies of engineer port construction and repair groups.

Initial emphasis in the affiliation program will be placed upon formation of Class C units, consisting of a minimum of 60 percent of authorized officer strength. Progressively, these are to be expanded into Class B units, consisting of a minimum of 80 percent of authorized officer strength and a cadre of key enlisted men; and Class A units consisting of a minimum complement of 80 percent of officer strength and 40 percent of authorized enlisted personnel.

Welded Design Eliminates Dead Weight in 4-Story Structure

By Roy L. Brown, Partner
Brown's Machine Shop, Sedalia, Mo.

THE all-welded design of our new four-story building now under construction has eliminated structural dead weight and thus increased each floor's capacity to carry heavy machinery loads. The reduction in steel and speedier erection with arc welding have also cut construction costs.

We designed the 92 x 120′ building for our own use as an automotive machine shop. All welding was done with "Fleetweld 47" electrode.

Double pipe columns reinforced with concrete are used throughout and are reported to be superior to conventional upright floor supports. Rising from the reinforced concrete basement floor to support the first floor are columns made of 10″ steel pipe with 6″ pipe inside, both filled with concrete and welded to a 2″ bearing plate.

ALL-STEEL FLOOR

Fig. 1 shows a similar 10″ double pipe columnar support for the second floor being welded to the top flange of a 24″ I beam at the first floor level. This column contains a 4″ pipe. The columns for upper stories are 7″ pipe with 4″ pipe inserted. In Fig. 1 bar joists have been welded to the I beams. Steel deck flooring was later welded to the bar joists. During construction this floor supported a truck and hoist to raise a 40-ft. beam weighing 4 tons.

Fig. 2. Two welders weld heavy beams simultaneously to avoid distortion.

Fig. 2 shows a vertical weld being made to join a curved lintel section to a straight lintel. Two welders are simultaneously welding on each side of the joint to maintain proper alignment. This procedure was used for welding all large beams. The curved lintel was shop-fabricated and hoisted into position for welding to straight lintels 80′ and 35′ long.

Fig. 3 shows the framework for the elevator penthouse and loading dock. Here 12″ door channels were formed from ¼″ steel plate and welded to a 13″ Z-bar, and 6″ x 6″ x ⅜″ angles were welded to the Z-bar to complete the lintel over the loading dock door.

Fig. 1. Welding pipe column to first floor I beam. Column has a smaller pipe and concrete inside.

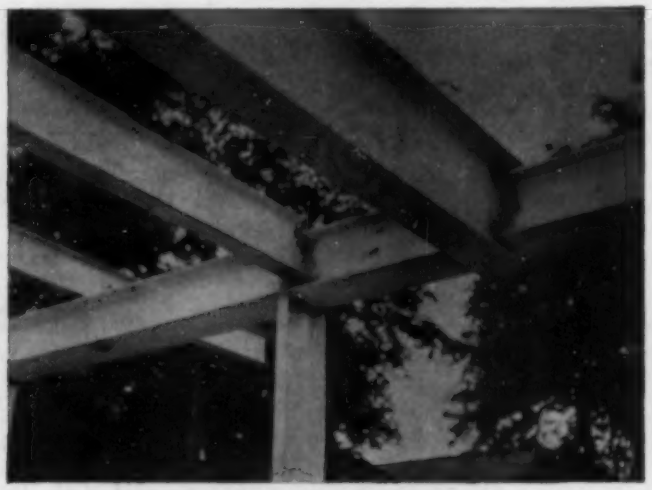


Fig. 3. Framework for loading dock contains channels, I beams, angles and Z-bar.

The above is published by LINCOLN ELECTRIC in the interests of progress. Structural Design Studies are available free to architects and engineers. Write The Lincoln Electric Company, Dept. 276, Cleveland 1, Ohio.

VMI Is Host to Two-Day Virginia Highway Conference

COOPERATION BETWEEN the various political subdivisions of the state and other groups interested in highway matters keynoted the addresses of prominent engineers who spoke at the two-day Virginia Highway Conference held recently at the Virginia Military Institute. The Conference—sponsored by the Virginia Department of Highways and the Virginia Military Institute with the Federal Public Roads Administration and a number of Virginia organizations cooperating—drew an attendance of about 700. There was general agreement among those present that the sessions were highly interesting and instructive and had served a useful purpose in bringing together a wide variety of viewpoints on the part of those interested in the continuing expansion and betterment of the Virginia highway system. Emphasis was placed on building the conference for the future.

ASCE was well represented on the list of speakers, and major credit for arranging and executing the program goes to an ASCE member, Col. R. A. Marr, head of the Civil Engineering Department at VMI. Sessions met in Jackson Memorial Hall at the Institute.

On the first day of the conference—following the address of welcome by Gen. R. J. Marshall, Superintendent of VMI, Virginia's State Highway Commissioner—J. A. Anderson, M. ASCE, spoke on "Interrelationship of Cities, Counties, Towns, and State in Highway Matters." The next speaker was Benjamin H. Petty, M. ASCE, professor of highway engineering at Purdue University and a distinguished figure in the field of highway engineering, who told of "Experience in Conducting a Road School." Other members of ASCE who presented addresses were Thomas H. MacDonald, Hon. M. ASCE, commissioner of the Public Roads Administration, whose subject was "The National Highway Outlook"; Kenneth B. Woods, M. ASCE, associate professor of highway engineering at Purdue, who discussed "Highway Research"; and Sterry J. Mahaffey, Assoc. M. ASCE, engineer-director of the Virginia Road Builders Association, who described the activities of his association.

Senator A. Willis Robertson presided over the afternoon session, at which Governor William M. Tuck presented the opening address. Governor Tuck stated his belief that all revenue from gasoline taxes should be devoted to betterment of the highways instead of being diverted to the general funds of the states.

Colgate W. Darden, Jr., president of the University of Virginia, in a dinner speech, emphasized his conviction that this country has nothing to fear from within, or in its relations with other countries, if the best use is made of its natural advantages and if its people settle down to hard work and bend their efforts to production.

On the second day of the conference, L. E. Akers, assistant highway engineer, Virginia Department of Highways, discussed "The Secondary Highway System," and group meetings of the cooperating organizations were held to plan for future meetings.

Survey Aims to Improve Port Facilities on Delaware River

PORT FACILITIES on the Delaware River are being surveyed with a view to their development and improvement, under a program recently initiated by the Delaware River Joint Commission of Pennsylvania and New Jersey. The section of river being investigated is that between Trenton and Delaware Bay, including Philadelphia, Pa., Trenton and Camden, N.J., and Wilmington, Del. To further the project, which calls for a program to attract both domestic and foreign trade to the river, the Commission appointed Maj. Gen. Harry B. Vaughan, M. ASCE, former U.S. District Engineer in Philadelphia, as port survey engineer.

The Knappen Engineering Co. of New York has been retained by the Commission to conduct the survey and prepare a report covering the weak and strong points of the port and to submit recommendations for increasing port business.

New York City Seeks to End Pollution of Streams

ELIMINATION OF POLLUTION from the waters around New York City is being undertaken in an initial program that proposes the construction of six new sewage disposal plants at a cost of $79,000,000. This expenditure would be the first phase of a general program, the second stage of which will cost about $84,000,000.

One proposal, under legal scrutiny, to finance the program is the issuing of water supply bonds exempt from the city's constitutional debt limit, for which enabling legislation would be sought in 1948. Should this method, which might involve increased water rates, be found legally impracticable, an alternative of imposing a sewer rent charge against users of sewage flush water may have to be considered.

Studies of the Tri-State Sanitary Commission disclosed that New York caused 75 percent of the pollution of its own waters.

U.S. and Great Britain Exchange Mapping Data

FREE EXCHANGE of technical mapping and surveying information between the United States and the British Empire will result from recent conferences in London, Secretary of the Interior J. A. Krug has announced. Wartime cooperation in these fields brought an invitation, through the State Department, for the attendance of the United States' observation group at this year's British Commonwealth Survey Officers conference.

Gerald Fitzgerald, chief of the topographic branch, U.S. Geological Survey, was named chairman of the delegation by the Department of State and was accompanied by nine technical representatives from the Departments of Commerce, War, Navy, Agriculture and the Joint Research and Development Board.

Mr. Fitzgerald's report has been forwarded to the Department of State by Secretary Krug.

New York Port Authority Establishes Advisory Board

TO FACILITATE ITS tremendous postwar expansion program, the Port of New York Authority has established a new engineering board of five members, who will advise it on engineering matters in its pending terminal construction program. The Port Authority's projected program for the next few years will involve the construction of airport and seaport facilities totaling more than $300,000,000.

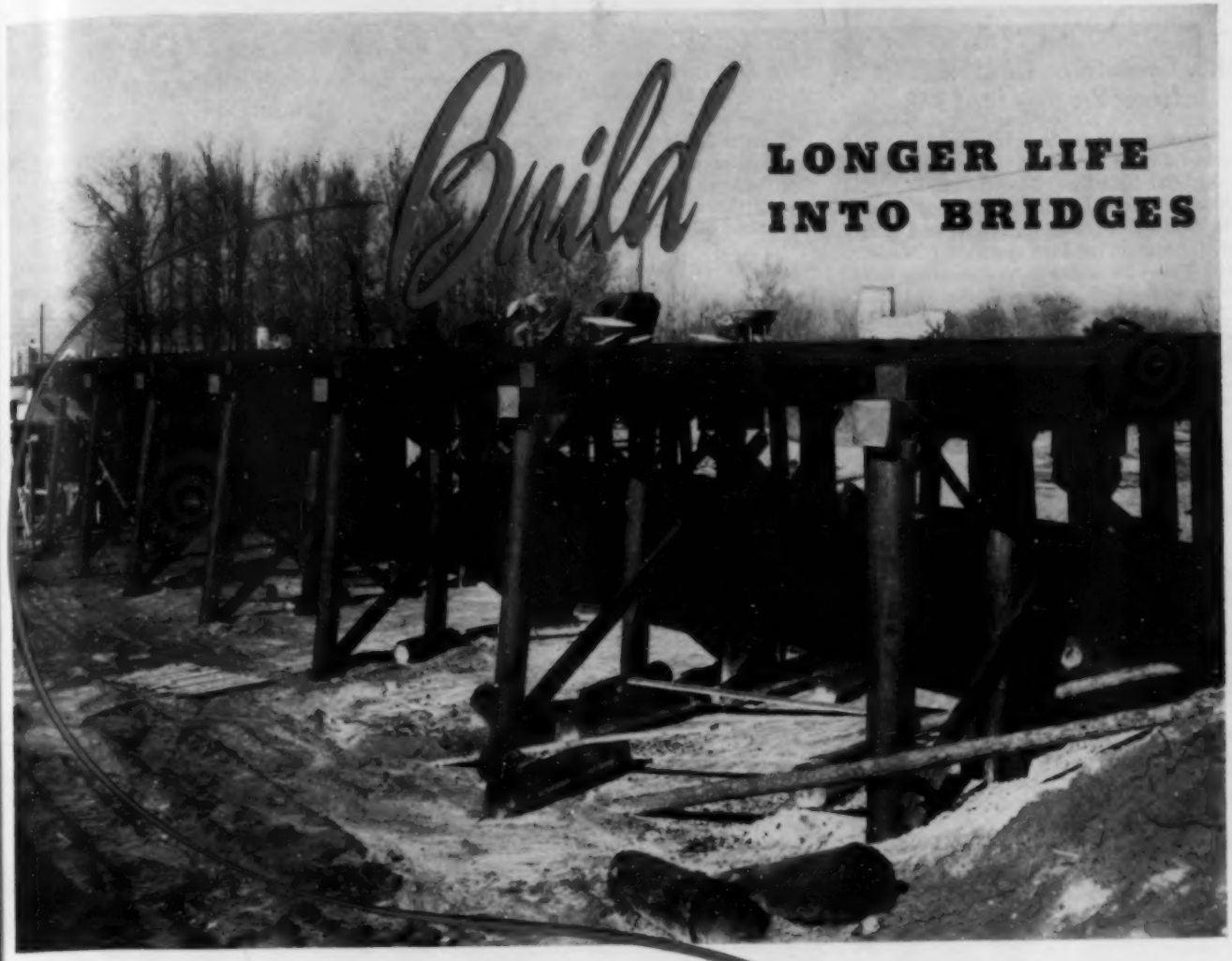
Chairman of the new board is J. C. Evans, M. ASCE, who has been promoted from his former position as chief engineer of the Port of New York Authority. Mr. Evans, who has been with the Port Authority since 1926, planned the approaches to the George Washington and Kill van Kull bridges and was consultant on the approaches to the Triborough Bridge and the New York City Tunnel. As chairman of the new board, he will continue to serve the Port Authority in a full-time capacity.

The rest of the board will consist of a group of New York City consultants—George W. Burpee, Frederic R. Harris, and William H. Mueser, Members ASCE, and Max H. Foley—who will serve the Port Authority in an advisory capacity. The new board will meet about once a week, at the call of its chairman.

Federal Aid Funds Help Promote Airport Program

UP TO NOVEMBER 5, the Civil Aeronautics Administration's Washington office had received 117 Project Applications for airport development, and at that time 104 Grant Offers had been made, involving $11,674,836 of federal-aid funds, according to a recent report of the ARBA Airport Division. This amount represents approximately 18 percent of federal-aid funds which have so far been appropriated for airport development under the Federal Airport Act. The figures outlined do not take into account projects which may be in the process of preparation for Project Applications at regional and district levels of CAA.

CAA officials in Washington have expressed the belief that 40 percent of available funds will be under Grant Offers by December 31 of this year, and that the rest of the funds that have been appropriated will be obligated by the spring of 1948.



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U.S. Commission for UNESCO Issues Program for 1948

IN RESPONSE TO a growing number of requests for information on the program of UNESCO that have come to the U.S. National Commission for that organization, the State Department has released a six-point program for 1948, entitled *UNESCO and You*. In addition to answering questions on the how, what and why of UNESCO, the publication outlines possibilities for achieving international understanding through education and suggests individual lines of action that may be effective for the various businesses and professions.

The engineering profession, through Engineers Joint Council, is represented on UNESCO's U.S. National Commission. Robert M. Gates, past-president ASME, is the EJC representative.

UNESCO and You may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., at a cost of 15 cents.

Examiners Raise Standards for National Registration

HIGHER REQUIREMENTS for registration of engineers were approved at the recent annual meeting of the National Council of State Boards of Engineering Examiners held in New York, N.Y. Whereas the former qualification called for only four years of satisfactory experience in addition to graduation from an approved engineering college, the new requirement for a national certificate of qualification is ten or more years of engineering practice and the passing of a written examination. Graduation from an approved school counts as four years of experience. Engineers of long-established practice may secure certification on the basis of at least 15 years of experience.

Election of officers at the meeting brought two ASCE members into top posts, George M. Shepard, chief engineer of the St. Paul, Minn., department of public works, as president; and Alexander Blair, consulting engineer of Lake Placid, Fla., as vice-president.

Predict Mild Recession Will Not Affect Construction

STABILIZATION IN CONSTRUCTION activities or a steady upward trend in dollar volume of contracts—with an overall median increase of 10 percent in construction volume, during a mild business recession beginning early next spring—is predicted by a majority group in a consensus of 100 leading economists who have completed a national survey of the country's price, production, employment and construction conditions.

Out of a group of 76 economists who expressed an opinion on the construction outlook, 37 anticipate a steady uptrend and 28 an approximately stable condition, while only 11 expect a steady downtrend. Fifty-eight of the 76 believe there will be an overall increase in construction contract volume.

That a general business slowdown will occur in 1948 is the general opinion expressed by the economists, eleven of whom think it will be "serious" and 19 "moderately serious." The survey, made by the F. W. Dodge Corp. of New York, indicates a wide diversity of opinion as to when general business stabilization will begin, ranging all the way from the present time to some time in 1951.

Construction Problems Are Studied by Advisory Council

IN A SPIRITED two-day meeting of the Construction Industry Advisory Council at the Chamber of Commerce of the United States in Washington, D.C., November 19 and 20, many of the important problems facing the construction industry were discussed by experts in various fields. In the absence of this year's chairman, John C. Stevens, Past-President ASCE, the meeting was presided over by James Edmunds of Baltimore, past-president of the American Institute of Architects.

An answer to the critics of the American construction industry was given on the first day of the meeting by Robert W. McChesney, president of the National Electrical Contractors Association. The speaker stressed the fact that two years after the end of the war American builders are producing at an annual rate of 950,000 housing units a year. The previous peak was 937,000 in 1925. Along with this high volume of residential construction he pointed to a substantial increase in the amount of commercial and other construction. Critics of the industry, said Mr. McChesney, have made it an emotional and political issue. "Some of the attacks on the industry are not criticisms: they are merely smears."

Other speakers at the opening session of the two-day conference, attended by representatives of more than a hundred national trade and professional organizations with a direct interest in construction, included Thomas S. Holden, president of the F. W. Dodge Corp., who presented a forecast of construction volume for 1948; and C. H. H Weikel, manager of commercial research for the Bethlehem Steel Co., who discussed the outlook for steel.

On the second day of the meeting papers were presented by R. R. Irvine and E. Compton Timberlake on the adoption of nationally accepted codes; and by Carl B. Jansen and Richard J. Gray on "What About Productivity?"

A FIVE-DAY TRAIN TOUR, June 13–17, 1948, to a hydro-station north of the Arctic Circle is planned in connection with the Stockholm Large Dam Congress (November CIVIL ENGINEERING, page 58). The cost will approximate $100. As train accommodations are limited to 20 engineers and their wives, those wishing to make the tour should apply for immediate reservations. Address Commissioner Michael W. Straus, Chairman, United States Committee on Large Dams, Bureau of Reclamation, Washington, D.C.

Ice Age Boulder Poses Unusual Highway Problem

HEAVIEST WHEEL LOADS of traffic on New Jersey's first freeway, Route 100, in Woodbridge, Middlesex County, will be challenged by a lone heavy boulder that drifted to the site an estimated 25,000 years ago.

Too tough to break, it was buried on the excavated grade for the new freeway where it will contribute to the firm foundation in New Jersey's program for arteries of the most practical design for safety. Predictions indicate that it will be undisturbed for many more centuries, resisting even the wildest vagaries of the "Sunday drivers."

J. E. Dederick, State Highway Department resident engineer, referred to the oddity in the following report:

"At Station 326 + 50, approximately 10 ft left of center line, an interesting phenomenon was encountered in the form of a large igneous rock or gneiss, 4 ft below ground surface. This hard gray rock, resembling granite, measuring 9.5 ft wide by 11 ft long and 4.5 ft thick, had evidently been deposited in the clay soil during the 'Glacial Age.' An isolated boulder of this size (17 to 18 cu yd) is an oddity and seldom found in our cuts."

Smaller boulders at the site presented no problem of disposal but the large one was too heavy for transporting and too hard to break up. It was pushed back and forth a number of times during excavation stages by a bulldozer until finished subgrade was reached. The boulder was buried at the identical location in which it was found, 3 ft below the new subgrade and 10 ft below its original position.

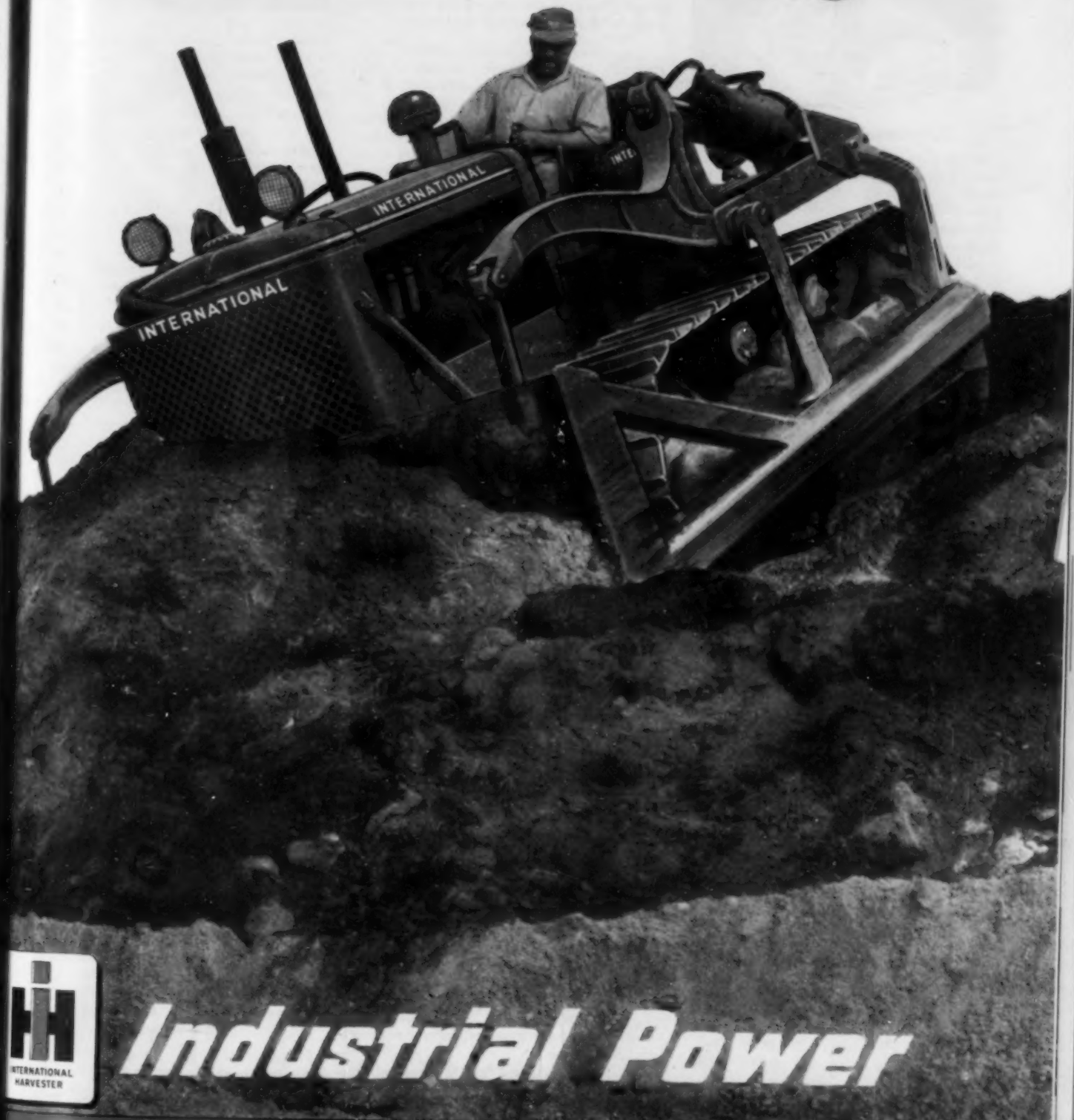
Uniform Building Code Is Subject of Meeting

COMPLETING 25 YEARS of maintenance of the Uniform Building Code, the Pacific Coast Building Officials Conference and the Uniform Building Code Association, at their Silver Anniversary Annual Business Meeting held recently at the Grand Canyon, Arizona, were host to 200 building officials from all over the United States and Canada.

Featured speakers included Senator Ernest W. McFarland, United States Senator from Arizona; James W. Follin, M. ASCE assistant administrator, Federal Works Agency, Washington, D.C.; James H. Mooney, president of the Building Officials Conference of America, Boston, Mass.; Franklin P. Ulrich, M. ASCE, chief of the Seismological Field Survey, U.S. Coast and Geodetic Survey, San Francisco, Calif.; Gilbert E. Morris, general manager of the Building Department, City of Los Angeles; and William J. Fox, chief engineer, Department of Building and Safety, County of Los Angeles.

The Uniform Building Code is now adopted in nearly 500 cities and counties of the United States. The states of New Mexico and Indiana are operating under the code, as well as cities throughout the territories of Alaska and Hawaii. A total population of 18 million is now under the Uniform Building Code.

EARTH MOVER



INTERNATIONAL HARVESTER

Industrial Power

R. Robinson Rowe, M. ASCE

WITH THE XMAS SEASON approaching, there was a generous spirit prevading the smoke smirched banquet hall of the Engineers Club. Even the newly enfranchised Juniors were betting they could muster the votes to raise Society dues when they had a chance, but Professor Neare reminded them of the stern necessity of solving Lon Moore's lawnmower problem before his tracks were snowed over.

"You recall," he explained, "that we were given the four sides of his quadrilateral lawn and two sides of the uncut plot after Lon had cut 21 swathes, to find the width of a swathe and how nearly he was done."

"I outsmarted you, Professor," bragged Joe Kerr. "I saw that the quadrilateral was a pair of right triangles, since $120^2 + 50^2 = 78^2 + 104^2 = 130^2$. Likewise the uncut plot must be a pair of right triangles, so the unknown sides u and v are related by

$$u^2 + v^2 = 43^2 + 6^2 = 1{,}885 \ldots . (1)$$

Also it is clear that

$$u - v = 120 + 78 - 104 - 50 + 6 - 43 = 7 \quad (2)$$

And these equations give $u = 34$ and $v = 27$, from which it is simple to find that Lon cut a 16-in. swathe and was $^{11}/_{12}$ done."

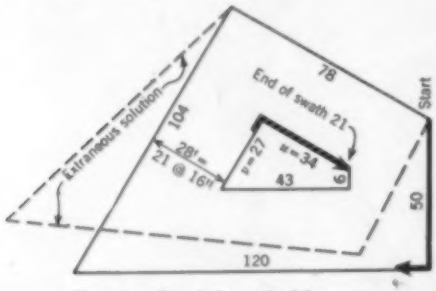


Fig. 1. Lon's lopsided lawn.

"Joe was lucky," complained Cal Klater. "Except for a condition he ignored, there would be two solutions, and I came prepared to show my derivation of both and why the other had to be discarded because of the condition that the widest angle lay between the 50-ft and 78-ft sides."

"That makes everybody right," grinned the Professor. The solution is easy for an inscribed quadrilateral, like Lon's lawn, and easier for a circumscribed quadrilateral. For a general quadrilateral the trigonometry becomes intricate, as Cal found out—too intricate for a teaser but a very fine problem and difficult to set up in integers.

"While we are talking quadrilaterals, you might be interested to take an 8×10 rectangular card and fold up a 5×10 corner triangle. The upturned corner will fall on the top edge and the figure will be a quadrilateral divided into three right triangles whose areas are in the ratios 6:24:25.

"Now for a problem, suppose you made a similar fold on another card and the areas of the three right triangles were in arithmetic progression. If the area of the smallest is 3 sq in., what is the area of the largest?"

[*Joes and Cals indiscriminately were Richard Jenney, Charles A. Ellis, Paul Seide, the anonymous A. Nuther Nutt, E. P. Goodrich (who did it with his eyes shut), W. F. Sloan, John L. Nagle and Ann Othernut (J. Charles Rathbun). Also acknowledged is a solution of the September problem of the odd weight in four weighings from Coleman W. Jenkins—a correct solution at long last.*]

New Safety Engineering Organization Is Formed

AFTER FUNCTIONING FOR almost a quarter of a century as an engineering section of the National Safety Council, the American Society of Safety Engineers became an independent organization by recent vote of its membership. Headquarters of the new organization will remain in Chicago, and the National Safety Council will continue its financial support.

According to John S. Shaw, president of the new organization and director of safety for the Hercules Powder Co., action for independent status was taken in the belief that it will enable the group to expand its services in the safety field.

Meetings and Conferences

American Association for the Advancement of Science. Section M (the engineering group) of the American Association for the Advancement of Science is sponsoring a joint meeting with the Limnological Society of America on December 30, as part of the annual meeting of the Association, which is to be held in Chicago, December 26–31. Information regarding the Section M program may be obtained from Prof. Frank D. Carvin, Newark College of Engineering, Newark, N.J.

American Society for Engineering Education. A series of engineering conferences comprise the afternoon program for the fall meeting of the Middle Atlantic Section of the American Society for Engineering Education—to be held at Pratt Institute, Brooklyn, N.Y., on December 6. Prof. E. K. Timby, Assoc. M. ASCE, of Princeton University, is chairman of the civil engineering conference.

American Society of Mechanical Engineers. New and coming developments in nuclear energy, rocketry, gas turbines, jet propulsion, fuels, safety, management and other engineering fields are being discussed at the 68th annual meeting of the American Society of Mechanical Engineers, December 1–5. The meeting is being held at the Chalfonte-Haddon Hall Hotel, Atlantic City, N.J.

CONCRETE BLOCKS 5 ft wide, 10 ft long and 5 ft thick have proved to be the best and least expensive shielding of the University of California cyclotron.

5,000,000 PAGES of German technical data including 145,000 patent applications are now in the hands of the Department of Commerce Office of Technical Services on 5,000 reels of microfilm.

SINCE 1940 the population of the Pacific States increased more than 38 percent.

THE NON-METALLIC MINERAL Vermiculite, used extensively as an insulating material, expands or exfoliates to 16 times its original size when heated.

BECAUSE OF THE ENORMOUS SIZE ($9,000,000 to $10,000,000) and the risk involved, between 50 and 100 insurance companies are expected to divide insurance on the new Tacoma Narrows suspension bridge.

A SCENIC ROAD soon will be completed around the crater of the world's largest dormant volcano, 10,000 ft high, Haleakala, on the island of Maui, Hawaii.

A WEIGHT REDUCTION of 810 lb per lin ft has been accomplished in reconstruction of the highway deck of the Eads Bridge, St. Louis, reducing the total weight more than 600 tons.

HOLLAND'S RAILROADS are now operating electric and diesel-electric locomotives and streamlined coaches.

U.S. GEOPHYSICISTS are making tests for oil at the mouth of the Amazon River and other places in Brazil.

U.S. AND FRENCH INTERESTS are studying traffic problems in Rio de Janeiro in connection with a subway project.

IN 1946 the railroads are reported to have made $2^3/_4$ percent on their net investment in cars and engines and all other things necessary to maintain railroad service.

65 PERCENT of all urban traffic deaths occur at night.

AS MEASURED by the cost of commodities on a tonnage basis, water sells on a countrywide average of about 4 cents per ton delivered.

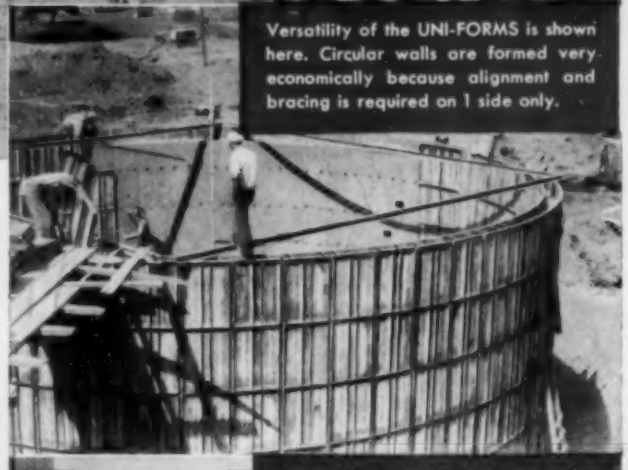
A $2,500 INCOME now is comparable to $1,535 in buying power in 1939. A $5,000 income after taxes is a $2,815 income of prewar days; a $10,000 income after taxes is a $5,193 prewar income.

DYNAMITE IS USED to explode ingots for research in steel-plant laboratories.

OIL WELLS 4 MILES DEEP may soon be possible.

HIGH-SPEED electronic computing machines ordered by Bureau of the Census will handle in 10 minutes problem now requiring 10 working days, involving multiplication of 100,000 pairs of 5-digit numbers and addition of the products.

UNI-FORMS have been widely used in the construction of industrial plants like this. Note the smooth walls, sharp, accurate corners and pleasing appearance of the concrete.



Versatility of the UNI-FORMS is shown here. Circular walls are formed very economically because alignment and bracing is required on 1 side only.

Foundation walls like this are speedily erected with a minimum amount of alignment and bracing on the outside only.

UNI-FORMS Handle *Every* Concrete Forming Job

UNI-FORMS can be used to form *any* type of concrete wall—circular, battered, or straight, with the same speed and economy that has made them the preferred prefabricated wall form.

They are faster to erect, easier to strip and require alignment on one side only—regardless of the type of wall being formed. UNI-FORMS are cutting forming time and costs *at least 50%*.

Economies in time and labor are only part of the story—material cost is lower than any other method of forming because UNI-FORMS can be used 30 to 50 times before replacement of plywood is necessary. The steel frame is indestructible.

Write for more information and illustrated literature on The UNI-FORM System of Wall Form Construction.

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NEW IN Education

COLLECTIONS OF WOOD SAMPLES in limited quantity are available at $2.00 per set from the Virginia Polytechnic Institute Wood Research Laboratory at Blacksburg, Va. Each set contains 40 samples, $\frac{1}{2} \times 2\frac{1}{2} \times 4\frac{1}{2}$ in., labeled with the common and botanical name, and with information on the range and use of the particular species. One sample of each of the following species is included in a set: Northern white pine, Western white pine, sugar pine, Western yellow pine, loblolly pine, shortleaf pine, longleaf pine, Douglas fir, Southern white cedar, Port Orford cedar, Eastern red cedar, redwood, red spruce, sitka spruce, Eastern hemlock, Southern cypress, Eastern cottonwood, black willow, magnolia, yellow poplar, red gum, tupelo gum, yellow buckeye, basswood, sugar maple, soft maple, hickory, pecan, chestnut, butternut, yellow birch, beech, white ash, sycamore, elm, black cherry, black walnut, white oak, red oak, black locust.

ESTABLISHMENT OF AN ENDOWED professorship in metallurgical engineering at Cornell University was announced by S. C. Hollister, M. ASCE, dean of the College of Engineering, at a recent dinner in honor of Francis N. Bard, of the Barco Manufacturing Co. of Chicago, donor of the $250,000 endowment fund. Prof. Peter E. Kyle has been designated to occupy the chair created by the fund, and the School of Chemical Engineering has been renamed the School of Chemical and Metallurgical Engineering to place greater emphasis on instruction and research in metallurgical engineering.

Reserve Corps Gets Training with Industry Cooperation

THAT INDUSTRY PARTICIPATION in the War Department's Affiliation Program is getting under way is evidenced by the signing of an agreement between the Corps of Engineers and the Caterpillar Tractor Co., of Peoria, Ill., the first major industrial plant in the Mid-West invited to participate. Under the new program at the Caterpillar plant, two reserve companies will be trained as specialists. One company, designated as Headquarters and Headquarters Company, Engineer Base Depot, will study top-level planning to serve 100,000 troops. The other company, an Engineer Base Equipment Company, will be trained in methods of receiving materials as in an overseas operation. The two Organized Reserve Corps companies, which are entirely voluntary, are working under a plan which contemplates sponsorship of certain key service-type units by civilian organizations whose functions are closely allied to the units' projected military assignments.

MORE THAN 4,000 students of civil engineering and architecture are studying the principles of good lumber construction this fall with the aid of the Timber Engineering Company's eleven-year-old program of supplying free copies of technical lumber literature for classroom use. This year the Washington, D.C., company supplemented its program by supplying 450 professors with a suggested outline course in timber engineering developed after two years of study by the company's engineers and a group of leading professors. In the month of October, 116 professors in 63 universities requested 18,400 pieces of literature under this program.

NORTHEASTERN UNIVERSITY'S expansion program has provided its Civil Engineering Department with a well-equipped Cement and Concrete Testing Laboratory, which is under the direction of Prof. Emil A. Gramstorff, M. ASCE, with operations in charge of Prof. Ernest L. Spencer, Jun. ASCE. The laboratory, covering 1,300 sq ft, contains two temperature and humidity controlled areas, one for cement testing and office space and one for concrete mixing, casting, and testing. Other equipment includes a well-insulated fog room; a deep-freeze unit and sonic modulus apparatus for freezing and thawing studies; a cement autoclave for soundness tests; and recording apparatus for maintaining records of temperature and humidity.

PLANS ARE COMPLETE for the 34th Annual Road School to be held at Purdue University in the Memorial Union Building February 2–5, 1948. It is expected that a road show will supplement the Road School.

New $3,500,000 Equipment Research Facilities Dedicated in Chicago

DEVOTED EXCLUSIVELY TO manufacturing research, a $3,500,000 unit of the International Harvester Co., recently dedicated in Chicago, is now in partial operation. Full operation by the department is not expected to be achieved until late next year.

Equipped with the most modern facilities in its 230,000 sq ft of area, the research department will: (1) investigate company manufacturing methods and problems, (2) develop manufacturing standards, and (3) keep abreast of all developments in the manufacturing world. The company intends eventually to make the results of such investigations available to general industry.

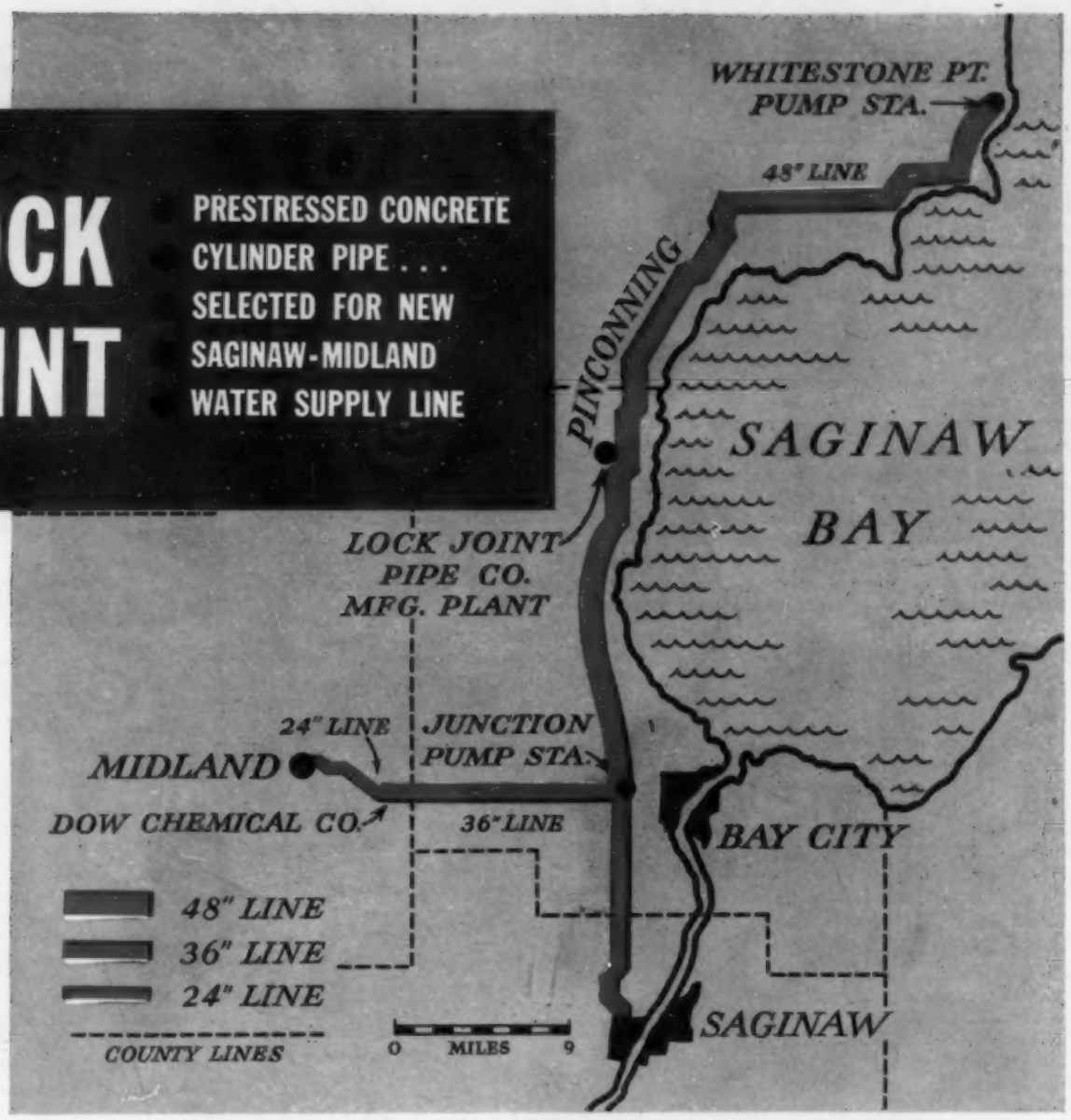
Among the new research divisions of special interest to the construction engineer are its welding, foundry, and forging sections for which machinery of the most modern kind is installed in the company's several branches.

The ASCE was represented at the new research department's dedication ceremonies by its Mid-West representative, George S. Salter, M. ASCE.

MEMBERS OF ROADS AND HIGHWAYS class at Illinois Institute of Technology, Chicago, inspect powerful International TD-24 diesel crawler tractor on visit to "Harvester's 100 Years in Chicago" exhibition on 10-acre site adjacent to Soldiers Field. Tractor, with bulldozer blade attached, weighs 46,000 lb. Inspection party, in clockwise order, comprises M. L. Mass, Jun. ASCE, instructor, and students Al Baker, J. C. Brown, Sheldon Phillips, Herb Levinson, Jim Morini, Dick Lofgren, Ted Smok and Don Ray.

LOCK JOINT

PRESTRESSED CONCRETE CYLINDER PIPE . . . SELECTED FOR NEW SAGINAW-MIDLAND WATER SUPPLY LINE



ONCE AGAIN, Lock Joint Prestressed Concrete Cylinder Pipe has been selected for a major water works project.

SPECIFICATIONS issued by the Saginaw-Midland Water Supply Commission call for the manufacture and installation of 254,500 feet of 48 inch pipe . . . 143,230 feet of 36 inch pipe . . . 14,900 feet of 24 inch pipe . . . all operating at a pressure of 130 pounds.

WHEN COMPLETED, this 78 mile water supply line will be capable of delivering 23 MGD to the city of Saginaw and 20 MGD to Midland.

BY SELECTING Lock Joint Prestressed Concrete Cylinder Pipe, the Saginaw-Midland Water Supply Commission assures itself of a pipe line of maximum elasticity, permanent high carrying capacity and an estimated life of one hundred years or more.

LOCK JOINT PIPE COMPANY

Established 1905

P. O. BOX 269, EAST ORANGE, NEW JERSEY

Denver, Colo. • Chicago, Ill. • Kenilworth, N. J. • Kansas City, Mo. • Rock Island, Ill. Joplin, Mo. • Valley Park, Mo. • Cleveland, Ohio • Hartford, Conn. • Navarre, Ohio

SCOPE OF SERVICES — Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.

LOCK JOINT *Reinforced Concrete* PRESSURE PIPE

New Publications

Highway Research. Proceedings of the 26th annual meeting of the Highway Research Board—held in Washington, D.C., in December 1946—have been published in book form. The 618-page volume includes a wide variety of papers on the design, construction, and maintenance of highways, traffic studies, and soils investigations. Editors of the Proceedings are ASCE Director Roy W. Crum, director of the Highway Research Board; Fred Burggraf, associate director; and William N. Carey, Jr., Assoc. M. ASCE, research engineer.

Railroad Transportation. Findings of the Railroad Committee for the Study of Transportation—an organization established by the Association of American Railroads in 1942 for the purpose of making a comprehensive study of all phases of the postwar economic and transportation situation—are summarized in a 391-page final report, entitled *Transportation in America*. Inquiries should be addressed to the Association of American Railroads, Transportation Building, Washington 6, D.C.

Beach Erosion. Current activities of the Beach Erosion Board are covered in its Bulletin No. 3, which may be obtained from the Office of the Chief of Engineers, Washington 16, D.C. In addition to articles on various aspects of beach erosion, the bulletin gives a bibliography of recent publications in the field, and lists the cooperative beach erosion studies in progress.

Lumber Specifications. "National Design Specification for Stress-Grade Lumber and Its Fastenings," originally issued in 1944 by the National Lumber Manufacturers Association, has been brought up to date with the revision of Table 1 on allowable unit stresses for stress-grade lumber. The 63-page specification may be purchased from the National Lumber Manufacturers Association, Washington, D.C., at a cost of 25 cents.

Sewage Treatment. Basic facts in the construction and financing of modern sewage treatment plants are outlined in a recent publication of the Portland Cement Association. The pamphlet, which is entitled "Sewage Treatment Works," will be furnished free in the United States and Canada, on request to the Portland Cement Association, 33 W. Grand Avenue, Chicago 10, Ill.

Steel Products. A new section in the Steel Products Manual, which is being issued in installments by the American Iron and Steel Institute, may now be purchased from the Institute, 350 Fifth Avenue, New York, N.Y., at a cost of 25 cents. The present bulletin, which is entitled "Section 7," deals with "Alloy Steel Plates."

Public Health. Educational and professional qualifications of the engineer in public health work are reviewed in a recent reprint from Vol. 37 of the *American Journal of Public Health*. Inquiries regarding the reprint, which is entitled "Educational Qualifications of Public Health Engineers," should be addressed to the American Public Health Association, 1790 Broadway, New York, N.Y.

Structural Analysis. To facilitate the analysis of indeterminate structures, the Portland Cement Association has issued a *Handbook of Frame Constants*, containing tables of carry-over and stiffness factors and fixed-end moments for a great variety of members and loading conditions. The handbook, which lists 27,050 constants for 1,390 members, is available without cost to residents of the United States and Canada, upon request to the Portland Cement Association, 33 West Grand Avenue, Chicago 10, Ill.

Grade-Crossing Accidents. An alarming increase in grade-crossing accidents in California in the past year is reported by the California Public Utilities Commission in its annual report, "Railroad-Highway Crossing Accidents," for 1946. The report was compiled by Ward Hall, M. ASCE, from accident records furnished the Commission by the railroads.

Highway Engineering. Economic aspects of providing off-street parking space in the interior of urban business blocks are discussed in Technical Report No. 3 of the Yale Bureau of Highway Traffic. The report, entitled "An Economic Study of Interior Block Parking Facilities," is published with funds furnished by the Eno Foundation for Highway Traffic Control.

Aluminum Specifications. New nomenclature for cast and wrought products, necessitated by continuing metallurgical advances, is made available in "Alcoa Temper Designations," a recent publication of the Aluminum Company of America.

Apprentice-Training Service. Functioning of the many-sided apprenticeship program of the Tennessee Valley Authority is described in a 67-page report recently published by the Apprentice-Training Service of the U.S. Department of Labor. The program, which covers 15 crafts, has been in operation since 1938. Copies of the report may be obtained free of charge from the Apprentice-Training Service, U. S. Department of Labor, Washington 25, D.C.

Asphalt Specifications. Additional and revised construction specifications of the Asphalt Institute, bound together in one book of 304 pages, replace the previous issue dated May 1, 1944. The book will be distributed on request to engineers and officials concerned with such designs, when requests are received on engineering or official letterhead. Apply to the Asphalt Institute, 801 Second Avenue, New York 17, N.Y.

Road Research. Two more releases of the British Department of Scientific and Industrial Research are now available upon application to H. M. Stationery Office, Kingsway, London, W.C. 2, England. The first of these, entitled "Impressions of Roads and Road Research in North America," summarizes observations made by British scientists on a recent visit to study American and Canadian highways. The price of the bulletin is 1/8d. The other publication, dealing with "The Grading of Aggregates and Workability of Concrete," sells for the same price.

NEWS OF Engineers

Murray D. Van Wagoner, consulting engineer of Detroit and former governor of Michigan, has been appointed director of the Office of Military Government for Bavaria by Gen. Lucius D. Clay. His headquarters will be in Munich. An authority on the design and construction of highways, Mr. Van Wagoner was for a number of years Michigan state highway commissioner. He is a past-president of the American Road Builders Association, and has represented the United States at the International Road Congress at The Hague. Recently he has been in Berlin as an engineering consultant to General Clay.

M. D. Van Wagoner

Edmund A. Prentis, nominee for ASCE Director and secretary and chief engineer of the New York City consulting firm of Spencer, White and Prentis, Inc., was one of ten prominent engineers initiated into Tau Beta Pi, honorary engineering society, at the 42d annual convention of that organization, which was held in New York City recently.

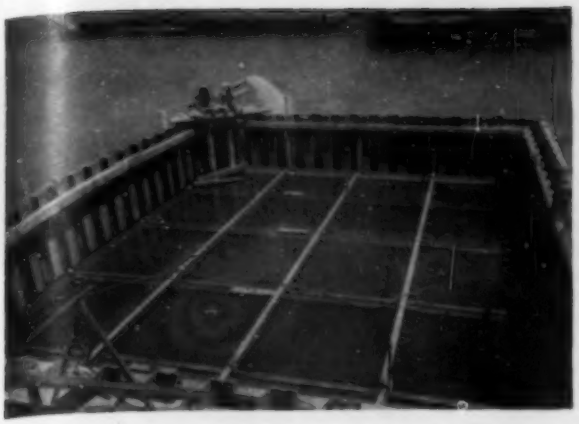
Jacob Wegweiser has resigned as field engineer for the Arthur A. Johnson Corp. on New York City subway reconstruction work to join the staff of the Irvington Farm and Tank Corp., with headquarters in New York City.

William Lewis Zeigler and **John A. Houseman** have formed a new engineering firm under the name of Zeigler, Houseman & Associates, with offices in Dallas, Tex. Mr. Zeigler recently resigned as district engineer for the American Institute of Steel Construction, Inc., at Dallas, and Mr. Houseman has been engaged in consulting work in Dallas for a number of years.

Forrest F. Varney, formerly senior engineer for the Sacramento District of the U.S. Engineer Office, has been appointed chief engineer and manager of the Nevada Irrigation District, with headquarters in Grass Valley, Calif.

Robert L. Morrison was the Knoxville (Tenn.) Good Government Group candidate for mayor of that city in the elections last month, but was eliminated from the runoff elections when he finished third in a field of eight. He had been acting city manager of Knoxville, and when the question of eliminating that office and electing a mayor became an issue, the Good Government Group selected Mr. Morrison to head its slate of candidates.

(*Continued on page 88*)

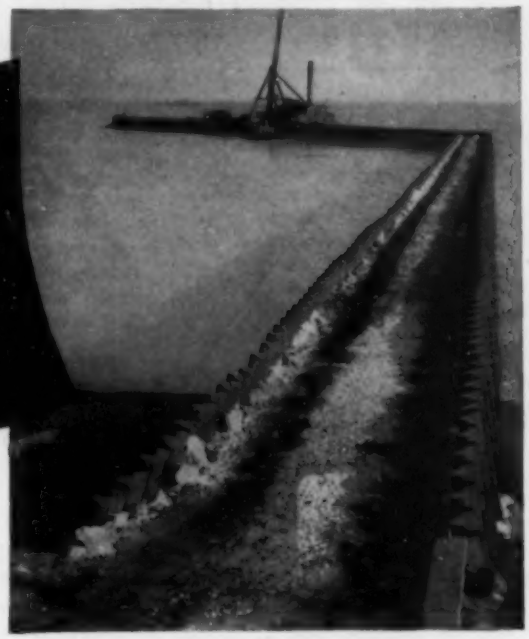


LESS BRACING NEEDED HERE. The high section strength of the U·S·S Steel Sheet Piling used to build this 50′ x 70′ cofferdam reduced the amount of bracing and provided more working room—factors which speeded the construction of the double-leaf bascule bridge across the Oakland Estuary.

SOLVING A PROBLEM of lower lake levels. When the wooden piling under this dock started to deteriorate due to exposure as the water level fell, the owner simply surrounded the dock on the water sides with a strong wall of U·S·S Steel Sheet Piling.

To keep earth and water in place—

U·S·S STEEL SHEET PILING



600 TONS OF U·S·S STEEL Sheet Piling are used in this 800 ft. pier and breakwater to assure permanent protection of Chicago's North Shore Park. Positive interlock is continuous through the lengths of the piling, assuring practical sand-and-water tightness.

Keeps Earth and Water in Place—Economically. In cut-off and core walls for dams and dikes, in wharves, slips, seawalls, in bridge pier retaining walls and in railroad and highway abutments, U·S·S Steel Sheet Piling offers easily installed construction that is strong, rugged and lasting. It forms a wall that is sandtight and continuous and that can be made watertight—an invaluable and versatile construction medium for any project involving the retention and control of earth or water, it offers the double advantage of speed and economy.

U·S·S Steel Sheet Piling is made of straight-web, arch-web, and Z-sections in a complete range of sizes and sections.

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh and Chicago

COLUMBIA STEEL COMPANY

San Francisco, Pacific Coast Distributors

TENNESSEE COAL, IRON & RAILROAD COMPANY

Birmingham, Southern Distributors

United States Steel Export Company, New York

7-98

USS STATES STEEL

TWO ASCE LIFE MEMBERS and Panama Canal engineers—Edward C. Sherman (left) and Tollef Mönniche—get together in Roanoke, Va., for first time since 1911 and discuss old days on construction of Canal. Mr. Sherman, now retired and living in Washington, D.C., was designing engineer for Canal spillways, 1909–1911. Former designing engineer for Canal lock chambers and emergency dams, Mr. Mönniche now manages coffee plantation in Boquete, Republic of Panama.

J. Trueman Thompson, head of the civil engineering department at the Johns Hopkins University, has been appointed a member of the newly created Maryland State Highway Council. The function of the council is to advise the State Roads Commission and the governor in connection with the projected expenditure, within the next few years, of approximately $200,000,000 for the improvement and development of the Maryland state highway system.

Elmer C. Osgood and **Karl N. Hendrickson** have joined the civil engineering staff of the University of Massachusetts (formerly Massachusetts State College) as assistant professors. Mr. Osgood was previously in the Public Works Department of the Navy, and Mr. Hendrickson was with E. B. Badger & Sons, of Boston.

Charles H. Meers, of Dallas, Tex., is studying for his master's degree in engineering and business administration at Massachusetts Institute of Technology.

Carl E. Arnold became Los Angeles County surveyor on November 1, succeeding **Alfred Jones,** of Pasadena, who is retiring after more than 35 years in the county surveyor's office. In his new capacity, Mr. Arnold will assume the duties of county engineer, including the installation of sanitary sewer facilities in the unincorporated area outside Long Beach.

William W. Brewer and **L. LeRoy Crandall** are now members of the Los Angeles consulting firm of Dames & Moore. Mr. Brewer was formerly office engineer at the San Francisco headquarters of the firm, and Mr. Crandall held a similar position in its Los Angeles office.

William M. Kinney is retiring as vice-president and general manager of the Portland Cement Co., Chicago, Ill., after 40 years of service with that organization and its subsidiaries. He has been general manager since 1918, and vice-president since 1931.

Harland Bartholomew, city planning engineer and consultant of St. Louis, Mo., will work with the Bar Harbor, Me., Planning Board on the rebuilding of that resort, which was partly destroyed in the recent forest fires. A member of the St. Louis Planning Board since 1916, Mr. Bartholomew has advised on the preparation of city plans and zoning ordinances for a number of American and Canadian cities.

Roger E. Kolm is now assistant professor of structural engineering at Lehigh University. Until lately he was structural designer for the Dravo Corp., at Pittsburgh, Pa.

Josiah B. Rutter, vice-president of the Monsanto Chemical Co. and general manager of its Merrimac, Mass., division, has been elected a member of the Board of Directors of the National Shawmut Bank.

Robert E. Pierce recently retired as principal highway engineer for the California Division of Highways, at Sacramento, after more than 30 years in the service of the Highway Division.

Raymond D. Wygant, formerly project engineer for the Federal Public Housing Authority in Honolulu, Hawaii, is now in Seoul, Korea, where he will do planning work with the 24th Army Corps of Engineers.

John C. Page, consulting engineer for the Bureau of Reclamation at Denver, Colo., and former Commissioner of Reclamation, retired from federal service on October 31. During Mr. Page's tenure as commissioner (1937 to 1943), the Bureau of Reclamation completed many important projects, including Grand Coulee, Imperial and Parker dams. Mr. Page resigned as commissioner in 1943 because of poor health, but later accepted a post as consulting engineer to the Bureau.

Wilson V. Binger is now chief of the soils and geology branch of the Missouri River Division of the Corps of Engineers at Omaha, Nebr. Until recently he was chief of the soils and foundations section, Special Engineering Division, the Panama Canal, at Diablo Heights, C.Z.

Henry K. Evans has resigned as director of traffic engineering for the National Conservation Bureau, New York City, to become West Coast representative for the Chicago consulting firm of De Leuw & Cather. His headquarters will be in San Francisco.

Gustave G. Werner, Jr., a partner in the New York City consulting firm of Malcolm Pirnie Engineers, has arrived in Athens, Greece, where he is acting as assistant project director for Atkinson-Drake-Park, in connection with the reconstruction of railroads, highways and other structures damaged in the war.

Mark S. Edson, supervising hydraulic engineer in the California Division of Water Resources at Sacramento, has retired after 25 years of service in the Division. He will make his home in Georgetown, Calif.

Sumner P. Wing has been appointed special representative of the Bureau of Reclamation to cooperate with the State Department and serve as liaison officer with irrigation representatives of foreign countries. As special representative, Mr. Wing will also participate for the Bureau of Reclamation in the program of the United States Interdepartmental Committee on Scientific and Cultural Cooperation. He has been with the Bureau of Reclamation since 1930. In his new capacity, Mr. Wing succeeds **William E. Corfitzen,** who was recently named irrigation adviser to the American Mission for Aid to Greece.

Sumner P. Wing

Hans Albert Einstein has severed his connection as research hydraulic engineer for the U.S. Soil Conservation Service at Pasadena, Calif., to accept the position of acting associate professor of engineering at the University of California. A son of Albert Einstein, the famous physicist, Mr. Einstein is an authority on the hydraulics of rivers and the transportation of sediment.

Roy E. Larson is now on the staff of James Stewart & Co., Inc., New York City construction company, in the capacity of head of the department of budgets and costs.

Carl A. Metz, with **Alfred Shaw** and **John Dolio,** has established an architectural and engineering practice in Chicago, under the firm name of Shaw, Metz & Dolio.

Charles D. Curran has accepted the position of chief of the Office of Water Control of the International Boundary and Water Commission at El Paso, Tex. Previously Mr. Curran was chief of the Power and Water Resources Group of the Bureau of the Budget, Washington, D.C.

William A. Oliver and **Ralph B. Peck** have been made full professors of civil engineering at the University of Illinois. Mr. Oliver was formerly associate professor of civil engineering, and Mr. Peck research assistant professor of soil mechanics.

Daniel Savitsky, formerly junior structural engineer for the Edo Aircraft Corp., at College Point, N.Y., has accepted a position with the Experimental Towing Tank of Stevens Institute of Technology, where he will do special research on seaplanes.

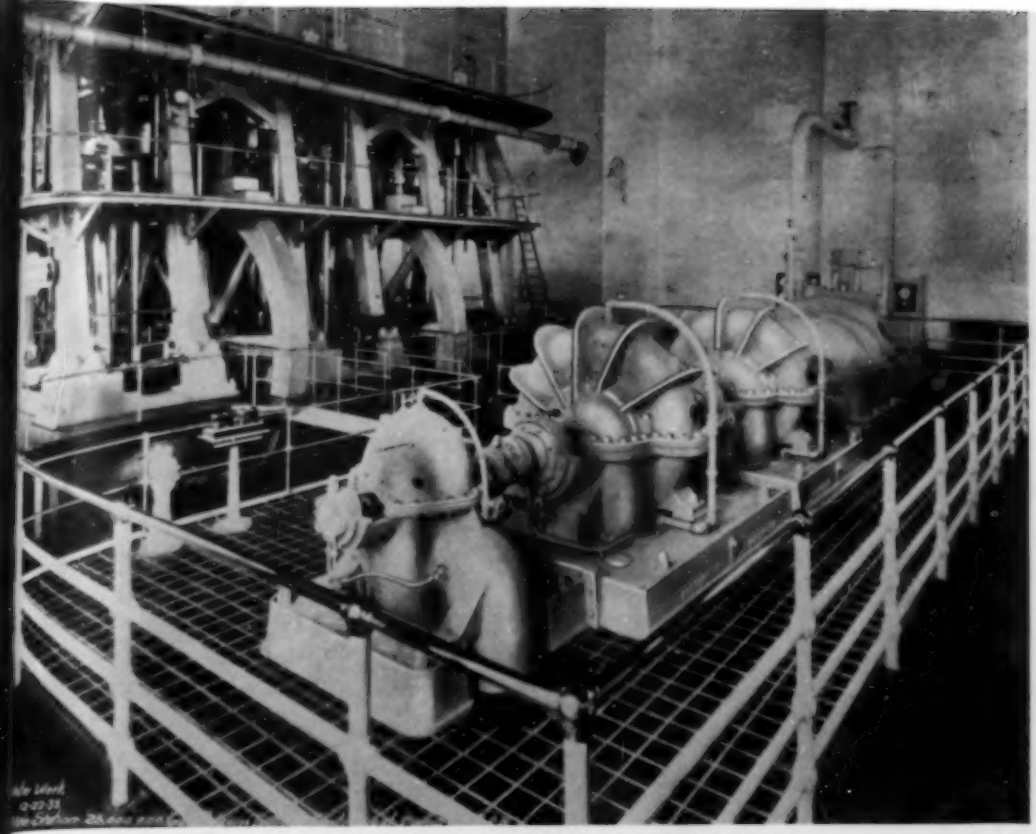
Oscar L. Johnson has opened an engineering office in East Peoria, Ill. Until lately he was sales engineer for the Barber-Greene Co., at Aurora, Ill.

John O. Joerns, assistant engineer for the U.S. Geological Survey, has been transferred from the Harlingen, Tex., sub-office of the Survey to the district office at Austin.

Francis E. Junior has severed his connection with the Cincinnati City Planning Commission to accept a position with the Portland Cement Association, with headquarters in Philadelphia. He will be area highway engineer on highway and airport pavements for the states of Ohio, Pennsylvania, Maryland, Delaware and West Virginia.

(*Continued on page 93*)

NEWS



Worthington turbine driven pump, Cincinnati Water Works, Ohio

1 Pump—25 MGD—210 PSI Head—14 Years

The Worthington pumping unit which was installed by Cincinnati Water Works in 1934 has been operating continuously ever since with scarcely any repairs.

The unit has a rating of 25 million gallons per day against a total head of 470 feet TDH.

The photograph of this unit provides an interesting comparison—in the foreground, the compact 25 mgd unit referred to; in the background a massive 25 mgd Worthington vertical triple expansion reciprocating engine installed over 40 years ago. The latter is one of seven such old time Worthington units still in service at this site.

Philadelphia Gets War-Delayed Pumps

Philadelphia's Bureau of Water began its modernization program in 1941 with the awarding of a contract to Worthington for furnishing and installing new motor-driven single and two-stage centrifugal pumping units for the Torresdale Pumping Station on the Delaware River. The contract covered the following units:

Four	40 mgd, 200 ft TDH,	1750 hp
Two	20 mgd, 200 ft TDH,	900 hp
One	6 mgd, 360 ft TDH,	500 hp
Three	3 mgd, 360 ft TDH,	250 hp

Torresdale Pumping Station of Philadelphia's Bureau ater to be equipped with Worthington pumping units.

Building of the new pump house and the delivery of the pumps were delayed by the war. As a temporary measure to supply increased demand, one 6 mgd unit and two 3 mgd units were put into service in a temporary pump house.

Recently, the bureau reinstated its program with an order to Worthington for the following units to be installed in the Queen Lane Raw Water Pumping Station:

Four	40 mgd, 260 ft TDH
Two	20 mgd, 260 ft TDH

The 40 mgd units are to be driven by 2250 hp unity power factor synchronous motors, the 20 mgd units by 1250 hp motors.

ORTHINGTON PUMP AND MACHINERY CORPORATION, HARRISON, N. J.

NEWS

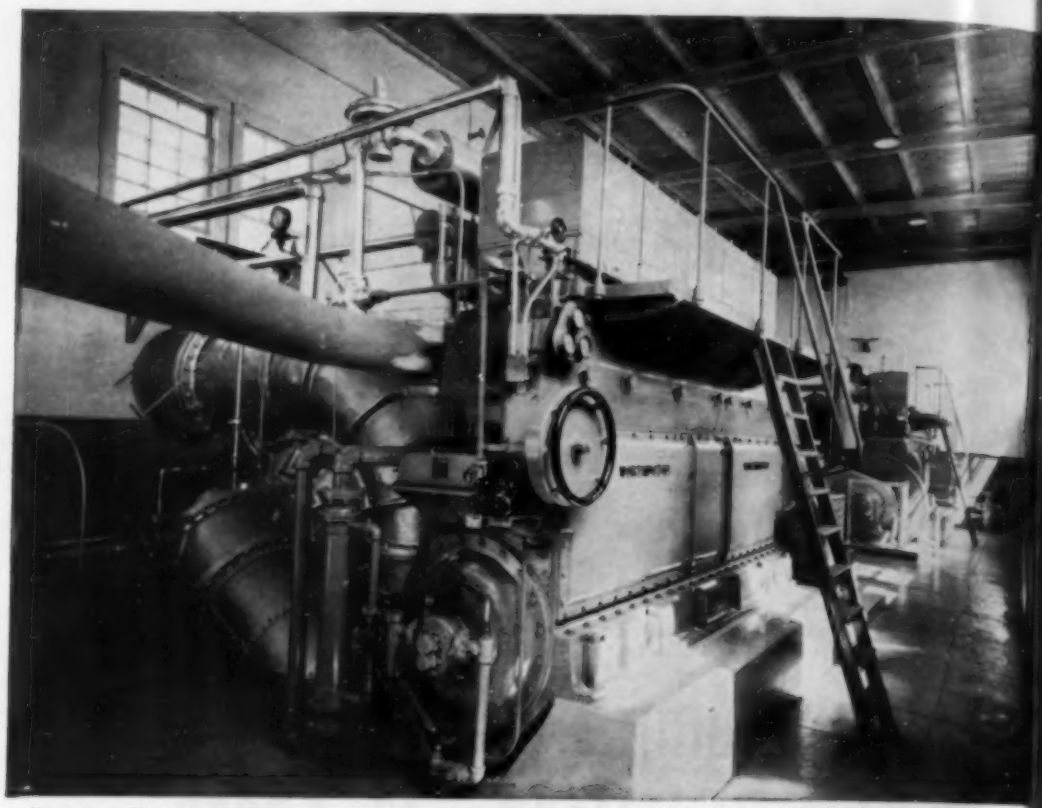
FROM THE PUBLIC WORKS FRONT

AS REPORTED BY THE DEVELOPMENT ENGINEERS, FIELD SERVICE REPRESENTATIVES AND CUSTOMERS OF WORTHINGTON

1

Public Works NEWS

NEWS from the public works front



Two Worthington 500 hp gas engines at second relift station of irrigation system located at Weslaco, Texas

Steam to Electricity to Gas— and the Same Worthington Pumps

Worthington pumps installed in 1915 and 1918 in Hidalgo and Cameron Counties' Water Control and Improvement District No. 9 relift plant north of Weslaco, Texas, have survived several transitions at the prime mover end and today are still operating, now with power supplied by Worthington gas engines.

Originally the pumps were powered by a tandem compound steam engine directly connected to the pump shaft. After several years' operation on steam, the pumps were converted to electric drive by installation of synchronous motors on the old engine shaft at the point where the flywheel had been located.

After operating for several years on electric drive, the discovery of oil and gas in the Rio Grande Valley made gas a much cheaper power source, and so gas engines and chain drives were installed, with the sprockets of the drive installed on the old engine shaft where the rotors of the electric motors had been located.

The gas engines are Worthington 500 hp vertical enclosed engines operating at 360 rpm through a silent chain drive to Worthington 45 in. horizontal double suction volute centrifugal pumps delivering 70,000 gpm against 18.5 ft TDH at 120 rpm.

The engines are equipped with air filter exhaust silencers and a closed jacket wat system. The jacket coolers consist of bare tub heat exchangers installed in the discharg canal in front of the pump outlet, and a sma water softener treats the jacket makeup.

The drive is lubricated from the oiling sy tem of the main pump bearings. This syste consists of a small belted rotary oil pump de livering to an overhead oil filter and storag tank from which the oil flows by gravity to th main pump bearings and chain, and drains t the base of the oil tight chain case, whence is picked up by the rotary pump.

A novel feature of the engine installation a friction brake to prevent the unit from run ning backwards in the event the main pum discharge flap or check valve failed to func tion. This is a hand-operated brake applie to the flywheel rim, and on one occasion sinc the plant was built an accident occurred to th discharge flap gate which would have prob ably caused serious damage to the engine ha this brake not been installed.

These Worthington units have been in ser vice for six years and are giving excellent re sults.

Veterans Hospital Contractor Using Blue Brutes 100%

Worthington "Blue Brutes" are doing their part in breaking ground for the new Franklin D. Roosevelt Veterans Hospital in Crugers Park, near Peekskill, N. Y. Contracts totalling $22,400,000 have been awarded for this hospital for neuropsychiatric veterans, which will be the largest Veterans Hospital in the United States.

The first contractor to start field work on the 900 day job of transforming the 383 acre site into a medical center was the Mt. Vernon Contracting Corporation of Mt. Vernon, New York, which has a $3,000,000 sub-contract for excavating, grading and other remodeling of the topography. The Mount Vernon Contracting Corporation is sub-contractor for Merritt, Chapman & Scott of New York City, and Fred J. Brotherton, Inc., of Hackensack, N. J., who have been awarded contracts for the major portion of the project.

The Mount Vernon Contracting Corporation is using 100% Worthington "Blue Brute" equipment on its rock excavation job. At the present time, there are nine 500-ft Diesel Portable Compressors, two 315-ft Diesel Portable Compressors, fourteen Wagon Drills, and eighteen Hand Held Rock Drills in operation.

Views of Worthington "Blue Brute" Compressors and Drills at site of Franklin D. Roosevelt Veterans Hospital

7-15

Worthington Pump and Machinery Corporation

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Harrison, N. J.

American Road Builders' Association

announces

TWO IMPORTANT MEETINGS IN 1948

HIGHWAY CONFERENCE

JANUARY 26-28

Mayflower, Statler and Willard Hotels

WASHINGTON, D. C.

An interesting 3-day program! Famous speakers, conferences, forums, reports of technical committees, business sessions, induction of new officers. The capital at the height of the season!

Make your hotel reservations AT ONCE! Congress will be in session at the time. Write, wire or phone for official application blanks today.

1948 ROAD SHOW

SOLDIER FIELD

and

45th Annual ARBA Convention

JULY 16-24

CHICAGO

The 1948 ROAD SHOW will be the largest exposition of equipment, machinery and materials used in the construction of highways and airports ever staged . . . for the first time, heavy machinery exhibited *AND OPERATED* out of doors in an area of over 1,200,000 square feet. 100,000 people will see it.

For information address

AMERICAN ROAD BUILDERS' ASSOCIATION

International Building

Washington 4, D. C.

Harold O. Hill, of Bethlehem, Pa., has been elected president of the American Welding Society for the year 1947–1948, assuming office at the close of the organization's annual meeting in October. Mr. Hill, who is assistant chief engineer of fabricated steel construction for the Bethlehem Steel Co., served the McClintic-Marshall Co. in a similar capacity from 1916 until 1931 when the company was merged with the Bethlehem Steel Co. He has held several offices in the American Welding Society, and has served on its research and other committees.

Harold O. Hill

Frederick H. Zurmuhlen, member of the New York City consulting firm of Corry-Zurmuhlen, has been appointed city commissioner of public works. Of recent years Mr. Zurmuhlen has been chief engineer for the George F. Driscoll Co., of New York, on the planning and construction of the Brownsville housing project.

Albert Givan has retired from his position as consulting engineer for the Sacramento Municipal Utility District after 24 years of service in that capacity. Mr. Givan was the first president of the Sacramento Section.

Thomas W. Stallworth, formerly a designer for Walter P. Moore, of Houston, Tex., has joined the civil engineering faculty at the Agricultural and Mechanical College of Texas, where he will divide his time between teaching and research work at the Texas Engineering Experiment Station.

Deceased

Arthur Merrick Newberry Blamphin (Assoc. M. '09) consulting engineer of New Orleans, La., died on October 16, at the age of 65. Beginning in 1904, Mr. Blamphin was for a number of years assistant city engineer at New Orleans, in charge of street paving and the installation of drainage systems. He had had a consulting practice in New Orleans for the past 20 years.

Herman Karl Endemann (M. '09) retired civil engineer of Forest Hills, N.Y., died on November 4. His age was 75. From 1891 until his retirement in 1939 Mr. Endemann was engaged in topographic work for New York City—for most of this period in the capacity of assistant engineer in the Queens Topographical Bureau.

Robert Rogers Evans (M. '09) retired engineer of Haverhill, Mass., died there on September 12, at the age of 74. As county engineer for Essex County, Massachusetts, from 1907 until his retirement in 1942, Mr. Evans supervised the construction of more than 200 dams in the county and of numerous bridges for Haverhill and other cities. Earlier in his career (1895 to 1907) he was city engineer of Haverhill.

Harvey Brown Fleming (M. '08) former chief engineer of the Chicago Surface Lines and president of the Chicago City Railway Co., died at his country home near Libertyville, Ill., on October 3. Mr. Fleming, who was 74, spent most of his career with street car companies in St. Louis and Chicago. He became connected with the Chicago City Railway Co. in 1899, and later was made chief engineer and vice-president. From 1930 until his retirement in 1945 he was president and chairman of the board.

James Edwin Gibson (M. '10) manager and engineer for the water department of Charleston, S.C., died in that city on October 15, at the age of 72. An authority in the field of water works engineering, Mr. Gibson was chief engineer for the American Pipe and Construction Co., owners and operators of the Philadelphia water works from 1897 to 1917. As head of the Charleston water department since the latter date, he constructed the Edisto-Goose Creek aqueduct to give the city a new water supply. A past-president and honorary member of the American Water Works Association, Mr. Gibson was the recipient of the association's Diven Medal in 1929 and of its Fuller Award in 1941.

Robert Pierce Gilbert (Jun. '39) assistant civil engineer in charge of a survey party for the California State Reclamation Board, Sacramento, Calif., was killed in an automobile accident near Merced, Calif., on October 9. Mr. Gilbert was 32 years old and an alumnus of the University of California, class of 1938. He had been in the Sacramento district of the Army Corps of Engineers, and for several years was junior hydraulic engineer for the U.S. Geological Survey at San Francisco.

Borden Baker Harris (M. '17) of Washington, D.C., died suddenly on October 26 while visiting in New York City. Mr. Harris, who was 72, was chief engineer in charge of the construction of the Philippine Railway in the early years of American occupation of the islands. Returning to the United States in 1913, he was associated with the J. G. White Engineering Corp. and the Associated Gas and Electric Co., in New York City, until his retirement about a year ago. Since his retirement he had lived in Washington.

Chester Arthur Hughes (M. '46) professor of structural engineering at Purdue University, died suddenly on October 20. Professor Hughes, who was 52, had joined the Purdue engineering staff only a month prior to his death. From 1920 to 1927 he taught at Toronto University, and from 1927 to 1947 he went through the various professorial ranks in structural engineering at the University of Minnesota. He conducted research studies on highway materials at the latter institution and has published papers on a wide variety of technical subjects. Canadian by birth, Professor Hughes served in the Canadian army in the recent war, attaining the rank of major.

Otto Heinrich Lang (M. '04) retired architect and engineer of Dallas, Tex., died on October 18, at the age of 83. Mr. Lang was born and educated in Germany, coming to the United States and settling in Dallas in 1890. From 1905 until his retirement in 1942, he was a member of the firm of Lang & Witchell. The first engineer in Texas to use reinforced concrete in skyscraper construction, he played a major role in building the city and beautifying its skyline. For some years Mr. Lang served as commissioner of streets and public property, and he was instrumental in revising and modernizing the city's building safety codes and establishing a city engineering department.

Joseph Raymond McLean (M. '27) head of the McLean Construction Co., general grading contractors, Superior, Wis., died on June 13. He was 59. Beginning in 1918, Mr. McLean was for a number of years with the Wisconsin Highway Commission, serving as maintenance engineer and division engineer. More recently he had been a member of the St. Paul, Minn., consulting firm of McLean & Hake.

Alejandro Melchor (M. '42) a colonel in the regular Philippine Army, Manila, P.I., died there on September 6, at the age of 43. A graduate of the University of the Philippines, Colonel Melchor came to the United States in 1940 to do graduate work at M.I.T. At the time he was head of the engineering department at the Philippine Military Academy, Baguio, P.I. Unable to return to his country because of the outbreak of war, he was assigned to the Engineer Board at Fort Belvoir, Va., and was later awarded the Legion of Merit for his work there on the design and development of bridging equipment for the armed forces.

Samuel Moorhead Russell (M. '05) retired engineer of Peoria, Ill., died about a year ago, according to word just received at Society Headquarters. From 1904 to 1916 Mr. Russell was superintendent of the Toledo, Peoria & Western Railway Co., which he later served as president. He had also been vice-president and director of the Peoria & Pekin Union Railway Co., and for some years prior to his retirement in 1943 was traffic representative for the Pennsylvania Railroad at Peoria.

Joseph Springer Swindells (M. '20) of Brooklyn, N.Y., died on January 3, 1947, though word of his death has just reached the Society. He was 72. Mr. Swindells had been with the New York Aqueduct Commission and the New York Board of Water Supply, and at one time was supervising engineer for the War Department in Puerto Rico. More recently he maintained a consulting practice in New York City, retiring several years ago.

Francis John Tresise (M. '11) of Buffalo, N.Y., died on October 16, at the age of 83. Born in England, Mr. Tresise was educated in this country and spent his career here. As assistant in the Buffalo, N.Y., Department of Public Works from 1894 to 1902, he was in charge of various municipal improvements. From 1902 to 1911 Mr. Tresise was associated with F. V. E. Bardol in an engineering practice in Buffalo, and from the latter year to 1935 he was president and general manager of the Erie Contracting

Co. More recently he had been consulting engineer for the company.

William Godfrey Wegner (M. '45) designing engineer for the Weyerhaeuser Timber Co., Tacoma, Wash., died in that city on August 25. Mr. Wegner, who was 50, had been with the Weyerhaeuser Timber Co. in a variety of capacities since 1921. Earlier he was with the U.S. Light & Heat Co. and the Titanium Alloy Co., both at Niagara Falls, N.Y.

Riffle Deflectors and Vortex Tubes Remove Suspended Silt

(*Continued from page 35*)

and the conditions under which such tests can be made. Visual observations over the past several months indicate that the structure is operating satisfactorily.

Another type of sand trap devised at the Fort Collins Laboratories is a practical device called the riffle vane type. In its present state of development it is not entirely immune from trouble. The vanes, formed of 8- or 10-gage sheet metal, are curved in plan and of special design. These vanes, when properly spaced and set in a line normal to the axis of the structure, will cause the bed load to move laterally across the channel immediately downstream from the line of deflectors.

This device is intended for use at ordinary velocities found in irrigation channels having a moderate width, and not for excessive bed load. Because of the nature of the vanes and spacing, it is found that debris moving along the bottom of the channel becomes lodged in the vanes and interferes with their action. Numerous other schemes for the removal of gravel, sand and silt from channels have been studied in the laboratories.

Wind-Tunnel Tests Determine Stability of Bridge Sections

(*Continued from page 43*)

same section $d/b = 0.26$ is shown in Fig. 6 (*b*). The indicated optimum proportions are $c = d/3$ and $s = b/11$, offering a 100 percent elimination of both catastrophic and limited instability.

Some Aerodynamically Stable Sections

Based on the foregoing studies, diagrams of some aerodynamically stable bridge sections (limited here to girder H-sections) are recorded in Fig. 7.

Diagrams 7 (*a*) and 7 (*b*) represent combinations of lateral slots and outside fins. The indicated optimum width of fins is $c = 0.08b$. The indicated optimum width of lateral slots ranges from $s = {}^1/_2 d$ to $s = {}^2/_3 d$ for sections from $d/b = 0.15$ to $d/b = 0.30$, respectively.

Diagrams 7 (*c*) and 7 (*d*) represent combinations of central slot and outside fins, applied to a section of ratio $d/b = 0.26$. The indicated governing proportion is $c = s$, or width of each fin equals width of central slot, this width having any value from $0.09b$ to $0.13b$.

Diagram 7 (*e*) represents a deep girder section with lateral slots and no outside fins. For the section ratio $d/b = 0.38$, the indicated slot width is $s = {}^1/_2 d$.

The girder H-sections represented in Fig. 7 range from $d/b = 0.15$ to $d/b = 0.38$. All of these sections are normally subject to catastrophic instability, either vertical or torsional or both. With the indicated modifications by slots or by combinations of slots and fins, all catastrophic instability is eliminated, and all limited instability is either eliminated or reduced to a negligible trace, below the threshold of normal structural damping.

Accordingly, within the applicable range, these modified sections offer complete aerodynamic stability, vertical, torsional, and coupled, for all angles of incidence and all amplitudes and at all wind velocities.

Problems of Heavy Construction Contractor in South America

(*Continued from page 28*)

can students in this country as we should. All too frequently these boys return home with their day-old diploma showing they are electrical, mechanical, sanitary or civil engineers. Tragedy and disappointment often follow. We should try and keep these boys here for an internship of about two years with our engineers or industries and then send them back to their homeland with some practical experience joined to their college work.

In all negotiations the writer's firm has dealt with competent, intelligent engineers, has encountered no unhappy experience and has had no difficulty in being paid for its projects. No irregular arrangements or questionable practices of any kind have ever been suggested. Foreign customs are not our customs but honest analysis often indicates that we could follow the customs of other countries to our advantage. Usually the acceptance of a project is quite a formal function at which executive representatives are present and signify their acceptance in the greatest spirit of cooperation.

Civil Engineers Share Knowlege of Fluid Mechanics

(*Continued from page 39*)

proposes to sponsor papers on the application of general flow principles to hydraulic engineering, with a symposium on high-velocity flow in open channels to be presented at an early meeting of the Society; (2) it hopes to take an active part in contributing to the forthcoming American journal abstracting current papers on applied mechanics; (3) it has prepared a general listing of available motion pictures on basic flow phenomena for educational use; and (4) it contemplates acting as a clearing house for design data on laboratory demonstration equipment. In order to accomplish its purpose most effectively, the Committee asks the understanding, cooperation, and constructive criticism of the Society membership.

Virginia Launches Record Highway Construction Program

(*Continued from page 22*)

Commission recently declared the Norfolk and Newport News bypass routes as limited-access highways. It is planned, in time, to make these roads of the expressway type, with no traffic crossing at grade. But such construction, while admittedly superior to any other type of highway, is justified in relatively few cases, owing to the tremendous costs. Development of expressways on the major intercity and interstate routes may be a goal for the future as existing roads reach the end of their useful lives—but such development is not being considered today. The Highway Department feels that first it must devote its time and money to more immediate needs.

Present Needs Are Staggering

Present needs—discounting those anticipated needs of 20 years hence—add up to staggering figures. An estimated 3,500 highway miles require immediate attention for the traffic of today. The Department breaks its urgent needs down in this fashion: Requiring widening, 1,275 miles; requiring widening and strengthening, 700 miles; requiring relocating, widening and strengthing, 1,525 miles.

The above needs represent a tremendous expenditure. Roads cost more, far more, today than they did when the primary system was originally established. Not only have construction costs skyrocketed, but road-building practices are far supe-

(*Continued on page 98*)

OPERATING EFFICIENCY

"WESTINGHOUSE-EQUIPPED THROUGHOUT" MEANS SIMPLIFIED ORDERING, QUICKER INSTALLATION, MORE EFFICIENT OPERATION

Putting power to work *productively* can be a major problem—or a simple one. When items must be selected, ordered and received from many sources, it means many chances for costly errors and delays . . . divided responsibility—or none at all—for performance of installed equipment.

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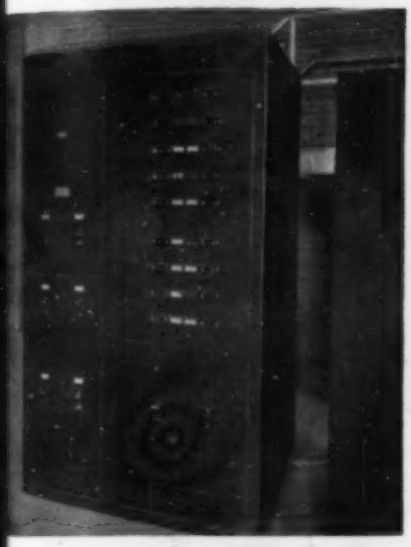
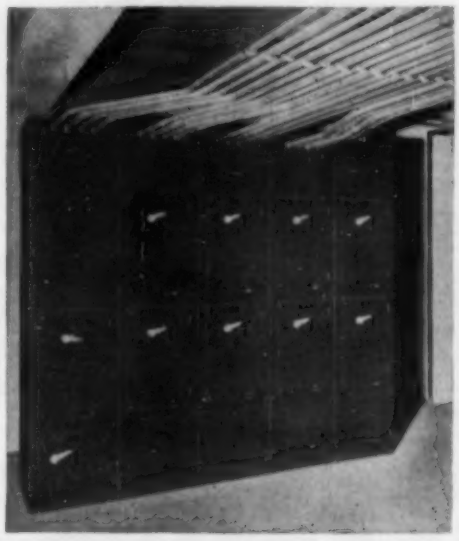


PANELBOARDS—Westinghouse control panelboard installed in a 9,000 gpm plant, including main incoming breaker, motor feeder breakers, lighting and auxiliary circuits; all in one attractive, easily installed unit.

CONTROL CENTERS—Typical Westinghouse Control Center which houses control for auxiliary motors at one centralized location—improves operating safety, simplifies operation and maintenance. Additional units can be added as needed.



SWITCHGEAR—Westinghouse Indoor Metal-clad Switchgear (2,300 volts) for feeder circuits to main pump motors. Factory assembled and tested to assure proper protection of vital equipment. Installed as a unit.

MOTORS—One 350/160 and one 250/100 hp two-speed Westinghouse CS Motors driving main sewage disposal pumps. (Metal-clad control panel in background.) These motors use low speed and low hp for normal sewage flow. High speed and high hp increase pumping capacity 300 percent for handling emergency conditions.

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PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

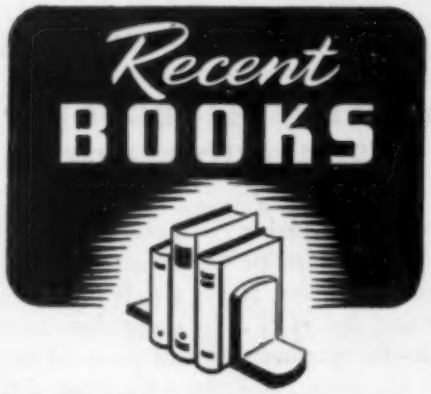
MORE PRODUCTIVE POWER FOR INDUSTRY

rior and considerably more expensive than in the past. Sand goes under concrete slabs today, facilitating drainage. This practice costs more—but the roads last longer and stay smoother. A rolling terrain is marked with expensive fills in modern construction—but the road will outlive its more cheaply constructed counterpart by many years, and lives will be saved by the better sight distance brought about. Traffic loads are far heavier; more expensive, more thorough construction must necessarily follow.

Looking ahead to an expanding Virginia highway system, one which will have lost its stigma of "obsolescence" within 20 years, the highway department is thoroughly in accord with the present-day tendency toward zoning, especially in rural sections. By making its future plans known to zoning authorities, the department is able to save itself and its citizens time and trouble in right-of-way questions of the future.

Looking toward the future, building and rebuilding with the needs of tomorrow always in mind, the department will make every effort to avoid the making of a like paradox which brought about the present state of inadequacy. Roads built today will not be inadequate tomorrow.

Planning and design engineers at the Virginia Highway Department's central office in Richmond are devoting long hours to programming the roads that will be built today, used today and adequate for the needs of tomorrow.



AMERICAN OIL OPERATIONS ABROAD. By L. M. Fanning. McGraw-Hill Book Co., New York and London, 1947. 270 pp., illus., diagrs., charts, tables. 8½ × 5½ in., cloth, $5.00. Presenting the story of the search for oil and the development of markets by Americans in foreign countries, this volume discusses the extent of our investments, the unique problems involved in oil deals with foreign lands, and the outlook for the future in world oil. The explorations of geologists, the building of oil camps, and the training of natives to become oil drillers and technicians are treated by picture and word. The author also discusses the effect on the economy, and the social and educational standards of the nations involved.

AMERICA'S NEEDS AND RESOURCES, A TWENTIETH CENTURY FUND SURVEY. By J. F. Dewhurst and Associates. The Twentieth Century Fund, New York (330 West 42d Street), 1947. 812 pp., charts, tables, 10¼ × 7 in., cloth, $5. Beginning with a survey of our wartime production and using the available reliable records of past economic changes, this volume contains basic estimates of future employment and productivity, and of population, income, consumption, and expenditure patterns of the future. The extensive statistical information is presented in over 250 tables. Containing over 800 pages, including a twenty-page index, this comprehensive study of our entire economic system is intended as a basic framework for future planning.

BUSINESS PLANNING AND CONTROL. By F. H. Rowland. Harper & Brothers, New York, 1947. 337 pp., diagrs., charts, tables, 8½ × 5½ in., cloth, $4.00. Using as a background his experience as a consultant to many corporations, the author considers the problems which face top management today, and analyzes the essentials of modern business organization and control. The first half of the volume outlines the factors in product selection, market forecasting, sales methods, and production plans. Specific techniques for budgetary control, organization procedures, and personnel policy are considered in the second half.

ELEMENTS OF ENGINEERING GEOLOGY, 2 ed. rev. By H. Ries and T. L. Watson. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 469 pp., illus., diagrs., maps, tables, 9 × 6 in., cloth, $5. The chief change in this new edition is the inclusion of two new chapters—one an expansion of the material on the geology of reservoirs and dams, and the other on historical geology. The revision also includes the modernization of references and problems. The usual geological material, highlighted where it has an important bearing on engineering, is well illustrated with maps, charts and references. An appendix, giving the addresses and directors of the geological survey offices of the various states and Canadian provinces, is a useful feature of the book.

AN INTRODUCTION TO SOIL MECHANICS, 2 ed. By W. L. Lowe-Brown. Pitman Publishing Corp., New York and Chicago, 1947. 61 pp., diagrs., charts, tables, 9 × 5½ in., cloth, $1.75. Presenting in simple language a short descriptive survey in soil mechanics, this volume will be of interest to practicing engineers. After some general introductory material, compression and consolidation of cohesive material are discussed, followed by material on the design of dams and weirs on permeable foundations. The fact is stressed that sound judgment and wide engineering experience are required in applying the principles of soil mechanics. A bibliography is included as well as several appendixes on earth pressure theories, slope stability, calculations.

(THE) LIFE AND WORK OF WILLIAM CAWTHORNE UNWIN. By E. G. Walker, with an introduction by Sir A. Chatterton. George Allen and Unwin Ltd., London, 1947. 239 pp., illus., 8½ × 5½ in., cloth, 12s. 6d. Extending from 1838 to 1933, the life span of William Cawthorne Unwin was coincident with the greatest period in the development of British engineering. This book describes his background, life and achievements as engineer, scientist and educator. Extensive quotation from contemporary letters and documents effectively reproduces the events and feeling of the times.

MATERIALS HANDBOOK, 6 ed. By G. S. Brady. McGraw-Hill Book Company, New York and London, 1947. 831 pp., charts, maps, tables, 8½ × 5½ in., cloth, $7. Useful to purchasing executives and product engineers, this book is a descriptive encyclopedia of industrial materials. It contains general information and patented and trade names of some processed and many raw materials. Detailed specifications are not given. Part I is devoted to definitions. Part II is a condensed handbook of general information ranging in scope from economic data to elementary nuclear physics. Statements regarding the characteristics of the materials and nomenclature used are backed by competent authorities or are common usage of well-known manufacturers.

PHILIPS RESISTANCE WELDING HANDBOOK. Philips Industrial (Philips Lamps Ltd.), Century House, Shaftesbury Ave., London, W.C.2, England, 1947. 210 pp., illus., diagrs., charts, tables, 9 × 5½ in., cloth, 10s. 6d. Dealing with the integration of resistance welding into the general process of production, this manual is of interest to those who wish to know practical applications. It is not intended to be a technical manual for the design of resistance welding machines. Welding equipment and principles, metallurgy of resistance welding, auxiliary equipment, and planning for resistance welding are the main topics covered. The reader should be familiar with the principles of electricity, magnetism, and general engineering.

SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS. Proceedings, Vol. 4, No. 2. Edited by C. Lipson and W. M. Murray; published and distributed by Addison-Wesley Press, Inc., Kendall Square, Cambridge 42, Mass., 1947. 121 pp., illus., diagrs., charts, tables, 11¼ × 8½ in., cloth, $6. A history of the Society, lists of members, and twelve papers are presented in this volume.

SURVIVAL AND RETIREMENT EXPERIENCE WITH WATER WORKS FACILITIES, a Committee Report. American Water Works Association, New York (500 Fifth Ave.), 1947. 566 pp., charts, tables, 9 × 6 in., cloth, $3. The American Water Works Association, with the cooperation of other associations in this field, has compiled this collection of records relating to the chief items of equipment used in water plants. The comprehensive and detailed tables show the number and length of life of such items of property as have been used and retired, the number and age of those still in service, and the distribution by ages throughout the life span. Twenty-six communities, exemplifying rapid, slow and normal growth and representing a geographical range from Canada to Florida and from New York to California, are cited.

(Continued on page 100)

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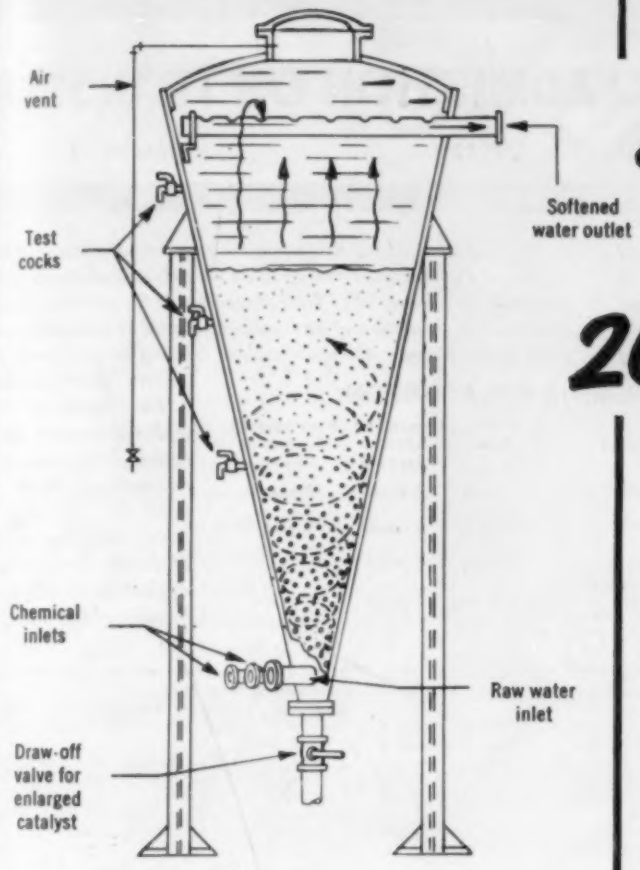

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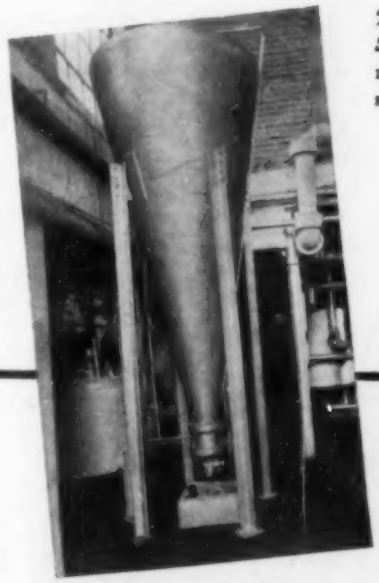

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SYMPOSIUM ON pH MEASUREMENT, 49th Annual Meeting, American Society for Testing Materials, Buffalo, N.Y., June 24–28, 1946. Technical Publication No. 73. American Society for Testing Materials, 1916 Race St., Philadelphia, Pa., 1947. 79 pp., diagrs., charts, tables, 9×6 in., paper, $1.50; to A.S.T.M. members, $1.15. This compilation presents seven papers on the latest theory and practice in colorimetric and potentiometric methods for making pH and closely related measurements. The following topics are covered: historical review, fundamentals and theoretical basis for pH determinations, recent advances in principal methods and techniques, and applications to particular fields.

TECHNICAL DRAWING PROBLEMS. By F. E. Giesecke, A. Mitchell and H. C. Spencer. 2 ed. Macmillan Company, New York, 1947. 9 pp. text, 105 sheets of diagrs., 11 × 9½ in., paper, ring binder, $2.75. Containing problems which are designed to cover the important fundamental principles of technical drawing, this volume is not intended for use as a complete course in itself. The problems are divided into units, and references are given under each unit to the section in *"Technical Drawing,"* second edition, by the same authors. Following a section on the use of instruments is one on the geometry of technical drawing. Succeeding sections discuss the construction of letters and numbers, problems on views, identification, revolutions, isometric and oblique drawing, and dimensioning. Problems on fasteners and springs complete the book.

APPLICATIONS FOR ADMISSION OR TRANSFER

December 1, 1947 **Number 12**

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every Member is urged, therefore, to scan carefully the list of candidates published each month in CIVIL ENGINEERING *and to furnish the Board with data which may aid it in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board. Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

GRADE	GENERAL REQUIREMENT	AGE	LENGTH OF ACTIVE PRACTICE	RESPONSIBLE CHARGE OF WORK
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years
Associate Member	Qualified to direct work	27 years	8 years	1 year
Junior	Qualified for subprofessional work	20 years	4 years	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years	5 years

APPLYING FOR MEMBER

ALDERTON, HENRY ARNOLD (Assoc. M.) (Age 51) Senior Highway Engr., U.S. PRA, Pasadena, Calif.

ANDREWS, CHARLES MORRISON (Assoc. M.) (Age 65) Senior Marine Engr., Bureau of Ships, U.S. Navy Dept., Washington, D.C.

ANTHONY, PAUL DIX (Age 53) Asst. to Dept. Engr., Hq. Dept., Board of Water Supply, New York City.

AUSTIN, VERLE LORRAINE (Assoc. M.) (Age 51) Hydr. Engr., U.S. Geological Survey, Austin, Tex.

BEAVERS, VIRGIL LOUIS (Assoc. M.) (Age 43) Member of firm, Beavers & Lodal, Cons. Engrs., San Antonio, Tex.

BECKENBACH, CHARLIE G. (Age 44) Major, Corps of Engrs., U.S. Army (Regular), En route to duty with Far Eastern Command, Tokyo, Japan; Dallas 8, Tex.

BELT, ROBERT MCCOLL (Age 40) Supt. of Public Works, Territory of Hawaii, Honolulu, Hawaii.

BENNETT, FRED V. (Age 38) Member of firm, Raub & Bennett, Costa, Mesa, Calif., Santa Ana, Calif.

BERNARD, WILLIAM CHARLES (Age 54) Chf. Engr., Technical Service Corp., St. Louis, Mo.

BIRNBAUM, MILTON (Age 56) Civ. Engr., Board of Water Supply, New York City.

BOUSFIELD, JAMES (Age 51) Civ Engr., Board of Water Supply, New York City.

BOYCE, RALPH EMMONS (Age 53) Civ. Engr., Board of Water Supply, New York City.

BOYLES, JESSE VARNEL (Assoc. M.) (Age 36) City Mgr., Bartow, Fla.

BURGER, JOSEPH ZENO (Age 49) Partner, Holabird & Root, Archts., Engrs. and Consultants, Chicago, Ill.

BURNEY, IRVING MORTON (Age 57) Civ. Engr., Board of Water Supply, New York City.

CASHDAN, HYMAN HAROLD (Assoc. M.) (Age 55) Civ. Engr., Board of Water Supply, New York City.

CHASE, ROLLAND WHITFIELD (Assoc. M.) (Age 48) Structural Engr., Pennsylvania Water & Power Co., Baltimore, Md.

CIRINO, NICHOLAS (Assoc. M.) (Age 40) Civ. Engr. & Archt. (private practice), San Francisco, Calif.

COLLARD, ARTHUR AYRES (Assoc. M.) (Age 42) Prof. of Civ. Eng. and Head of Civ. Eng. Dept., Rhode Island State Coll., Kingston, R.I.

COX, HAYWARD CARLTON (Assoc. M.) (Age 47) Senior Engr., Civ. Works Branch, Corps of Engrs., Atlanta, Ga.

CRAIG, EDWARD MARSHALL, JR. (Assoc. M.) (Age 52) Civ. Engr., Board of Water Supply, New York City.

DICKMANN, EMILIO (Age 41) Managing Director of firm, Sociedad Anonima de Obras Publicas y Privadas, Vicente Lopez, Argentina.

DIGENOVA, EGIDIO OTTAVIO (Assoc. M.) (Age 54) Civ. Engr., Board of Water Supply, New York City.

DIMOND, HARVEY GIRARD (Age 55) Chf. Draftsman, Gen. Drafting Room, Great Northern Ry., St. Paul, Minn.

DODGE, BERT EMERSON (Age 59) Structural Engr., Universal Atlas Cement Co., New York City.

DROUGHT, FRANCIS TUNSTALL (Assoc. M.) (Age 45) Cons. Engr., San Antonio, Tex.

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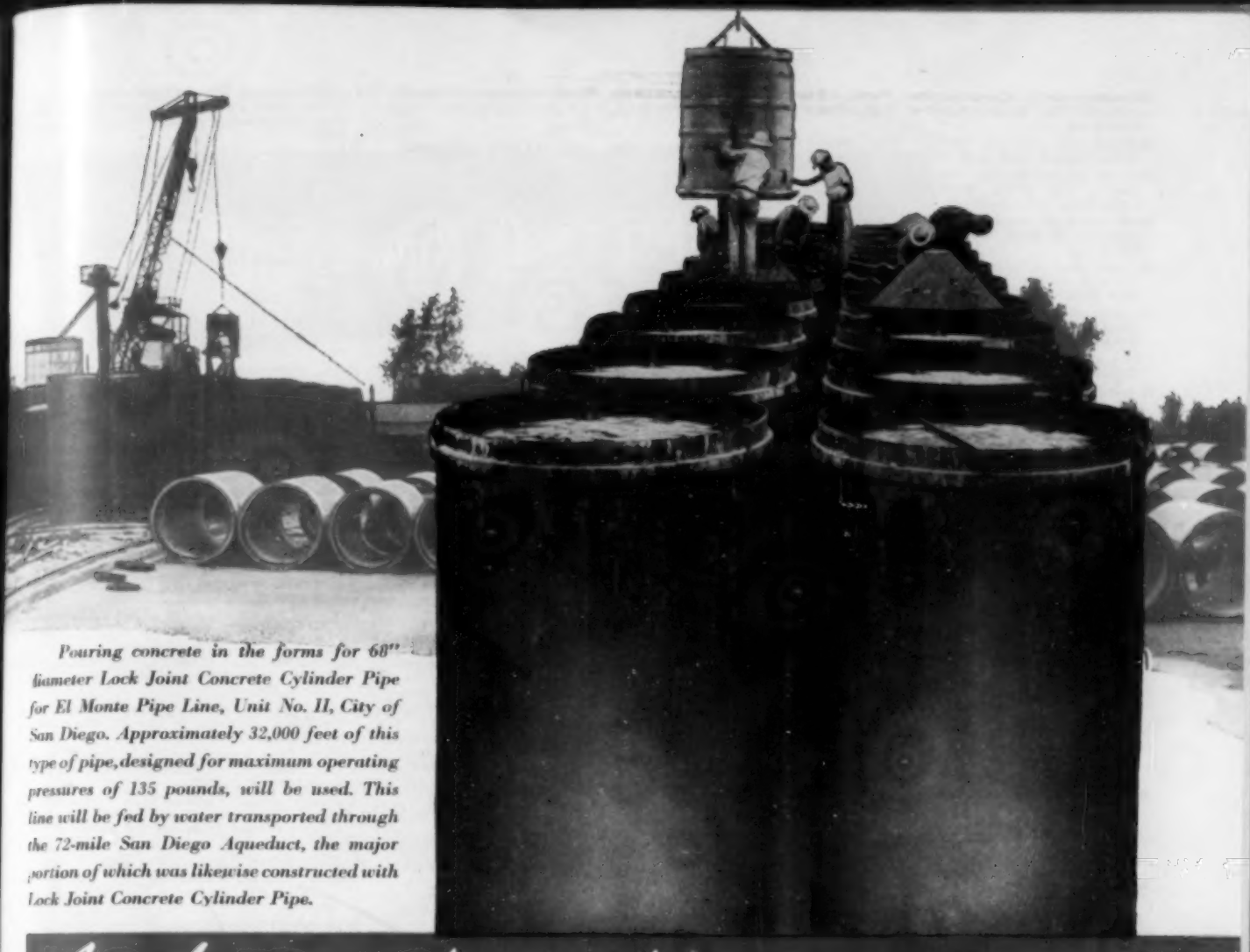

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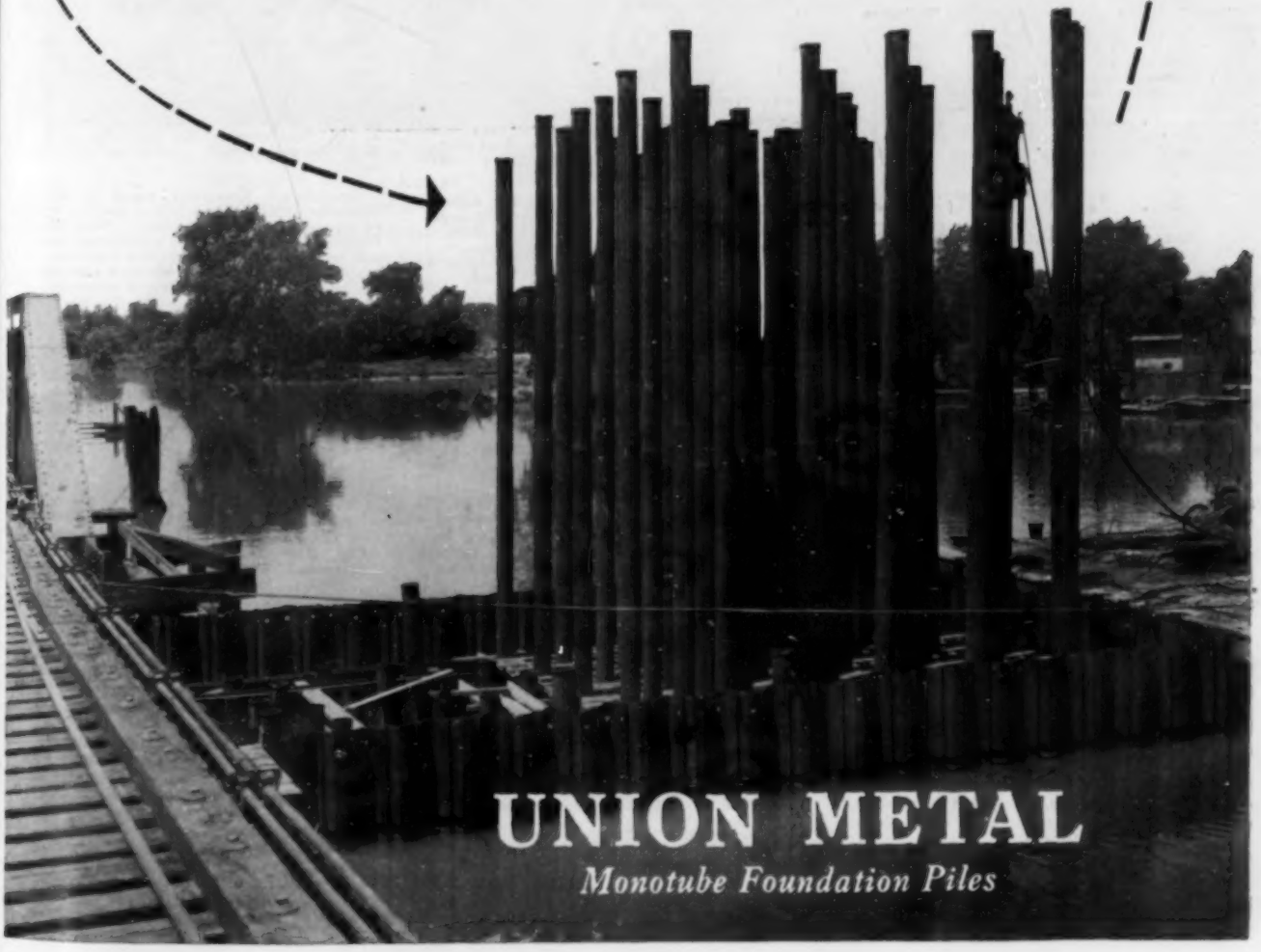

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STRUCTURAL ENGINEER, about 40, with considerable experience in bridge design; qualified in design of railroad bridges. After becoming familiar with the railroad's problems, employee will be given the title of Bridge Engineer. Preferably, the applicant should be a graduate civil engineer who has specialized in structures. Salary to start, $6,000 up a year. Location, northern Minnesota. R-4558C.

(*Continued from page 102*)

MATHEWSON, CHARLES ELLIS, JR. (Jun.) (Age 35) Engr., Fire Eng. Dept., Marsh & McLennan, Inc., New York City.

MAYFIELD, ISAAC NEWTON (Jun.) (Age 34) Office Engr., Austin Dist. Office, Portland Cement Association, Austin, Tex.

MERRYMAN, HAROLD WOODROW (Jun.) (Age 34) Asst. San. Engr., Oregon Board of Health; Univ., Cambridge, Mass.

MITCHELL, FRANCIS EUGENE (Jun.) (Age 34) Associate Prof., Coll. of Eng., Univ. of Arkansas, Fayetteville, Ark.

MOE, ALFRED BROX (Age 34) Airways Engr., CAA, Engr.-in-Chg. of Constr., at Experimental Station, Indianapolis, Ind.

MOORE, ETHAN DANA (Age 42) Dist. Engr., The Lane Constr. Corp., Meriden, Conn., and T. W. Cunningham, Inc., Bangor, Me.; Project Mgr. at Limestone (Me.) Army Air Base, Winchester, Mass.

MORGAN, HARRY A., JR. (Age 30) Engr., Fresh Milk & Ice Cream Div., Carnation Co., Los Angeles, Calif.; Inglewood, Calif.

MORRIS, ROBERT KESSLER (Jun.) (Age 27) Civ. Engr., Alden E. Stilson & Associates, Cons. Engrs., Columbus 9, Ohio.

MULLEN, JOHN WILLIAM, JR. (Age 37) Structural Engr. (private practice), Dallas, Tex.

NASVIK, PETER OLIVER (Jun.) (Age 34) Contr. (private practice), Nasvik Constr. Co., Los Angeles, Calif.

O'NEILL, JOHN THOMAS (Age 38) Lt. Col., Corps of Engrs., U.S. Army, Ft. Monroe, Va.

OWENS, RICHARD HENRY (Age 44) Archt., TVA, Knoxville, Tenn.

PALMER, STANLEY CANADA (Age 41) Constr. Engr. and Asst. City Engr., Kansas City, Mo.; Platte City, Mo.

PHILLIPS, HOWARD EMERSON (Jun.) (Age 35) Asst. to Engr. of Bldgs., American Telephone & Telegraph Co., New York City.

POWELL, RICHARD LEIGH (Jun.) (Age 38) Member of firm, Powell & Powell, Engrs., Dallas, Tex.

PRATT, CLYDE MONROE (Age 36) Borough Engr. and Director of Public Works, Leonia, N.J.

RALEIGH, JOHN CLARK (Jun.) (Age 35) Corporation Civ. Engr., John W. Stang Corp., San Pedro, Calif.

SALVERAGLIO-MAGGI, ALBERTO (Age 34) Engr., de la Direccion de Saneamiento, del Ministerio de Obras Publicas, Montevideo, Uruguay.

SCHERR, MICHAEL (Age 41) Asst. Civ. Engr., Board of Water Supply, New York City, Brooklyn, N.Y.

SCOTT, THOMAS JEFFERSON, JR. (Age 34) Asst. Project Mgr., Maxon Constr. Co., Inc., Monsanto Unit No. 5 (Atomic Energy), Miamisburg, Ohio.

SMITH, JOSEPH CURTIS (Age 31) Dist. Engr., Donald R. Warren Co., Los Angeles, Calif.; Berkeley, Calif.

SMITH, SIDNEY WILSON (Jun.) (Age 34) Associate Topographical Engr., U.S. Geological Survey, Walnut Creek, Calif.

SMITH, TRAVIS WARD (Age 35) Engr. (P-3), Corps of Engrs., Ft. Lincoln; Bismarck, N.Dak.

SPARLING, RAYMOND CARTER (Jun.) (Age 35) Owner, Sparling Foundry, Burbank, Calif.

SUMMER, WALTER BASSETT (Jun.) (Age 34) Structural Engr., Catalytic Constr. Co., Philadelphia, Pa.

TRICHMAN, PAUL FERDINAND (Age 61) Asst. Civ. Engr., Board of Water Supply, New York City.

TER MAATH, BERNARD HERMAN (Jun.) (Age 34) Chf. Engr., Byrne-Moline Communities, Inc., Moline, Ill.

THAYER, HANFORD (Age 38) Engr. P-4 (Civ.) being Asst. to Chf., Design Sec., Gen. Eng. Branch, Corps of Engrs., Seattle, Wash.

THOMA, EDWARD CHARLES (Jun.) (Age 30) Asst. Prof. of Civ. Eng., Purdue Univ., West Lafayette, Ind.

TURITZIN, ALEXANDER MICHAIL (Jun.) (Age 34) Squad Leader and Senior Structural Designer, Devenco, Inc., New York City.

VINCENT, JAMES CAMPBELL (Jun.) (Age 33) Member of firm, Vincent Eng. Co., Clarinda, Iowa.

WHITE, RONALD MCGLASHON (Age 45) Asst. City Engr., Dept. of Public Works, Kansas City, Mo.

WHITESELL, CARLIN HAMLIN, JR. (Age 32) Commissioned Officer, Corps of Engrs., U.S. Army (Regular), Cameron, Ill.

WILDER, CARL RUDOLPH (Jun.) (Age 34) With Portland Cement Association, Chicago, Ill.

WILLIAMS, BELMONT MURRAY (Jun.) (Age 35) Senior Traffic and Planning Engr., Dept. of Traffic & City Planning, Schenectady, N.Y.

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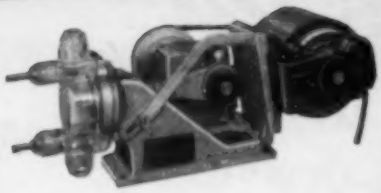

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WOODROW, ERNEST JOHN (Age 41) Highway Engr., P-4, 2414 Sunrise Ave., Roanoke, Va.

WOODRUFF, RICHARD SHAUL (Jun.) (Age 34) Engr., Transmission Lines, Eng. & Constr. Dept., Alabama Power Co., Birmingham, Ala.

WYSS, GERARD ADOLPH (Jun.) (Age 34) Civ. Eng. Associate, Dept. of Water & Power, Los Angeles, Calif.

YENCHKO, JOHN (Age 30) San. Engr., Bureau of San. Eng., Pennsylvania Dept. of Health, Dist. B Office, Wilkes-Barre, Pa.

APPLYING FOR AFFILIATE

JACKSON, HARRY (Age 46) Asst. Civ. Engr., Acting Senior Sec. Engr., Board of Water Supply, New York City.

APPLYING FOR JUNIOR

BLUM, FREDERIC LEONARD (Age 25) Draftsman, Essex County Highway Dept., Newark, N.J.

CHERSEBROUGH, FREDERICK WILLIAM (Age 30) Draftsman, Designer, Huber & Knapik, San Francisco, Calif.

COLQUITT, CLAUD WILEY (Age 29) Structural Engr., U.S. Engrs., War Dept., Mobile, Ala.

DAVAR, KERSI SORAB (Age 24) Asst. Engr. (under training), Great Indian Peninsula Ry., Girdhar Nivas, Colaba Causeway, Bombay, India.

DIEHL, HARRY KINGSLEY (Age 23) Maintenance Engr., CEC, USN, Gibson City, Ill.

DURHAM, LUCIAN ARCHAMBAULT, JR. (Age 27) Draftsman, Eng. Dept., Norfolk & Western Ry., Roanoke, Va.

FABER, JOHN GORDON (Age 26) Chartered Civ. and Structural Engr., South Croydon, Surrey, England.

FRAVEL, HARRISON DEAN, JR. (Age 22) Jun. Highway Engr., U.S. PRA, San Francisco, Calif.

GLOYNA, EARNEST FREDRICK (Age 26) Instructor in Civ. Eng., Univ. of Texas, Austin, Tex.

HARKAULI, ANAND NARAIN (Age 25) Graduate Student, Northwestern Univ., 1502 Hinman Ave., Evanston, Ill.

KETT, IRVING (Age 24) Jun. Engr., New York City Board of Transportation.

KIRJASSOFF, GORDON LOUIS (Age 24) Asst. Engr., Edwards & Kelcey, Cons. Engrs., New Brunswick, N.J.

LARSON, ERNEST DIXON (Age 25) Power and Fuel Engr., Geneva Steel Co., Geneva, Utah.

LITSCHAUER, ERNEST (Age 32) Jun. Civ. Engr., Board of Water Supply, New York City.

MCHUGH, WILLIAM (Age 26) Engr., Edward Fay & Son, Philadelphia, Pa.

MITWALLI, ABDUL-HAMID HOSANI (Age 26) Ministry of Public Works, Egypt, Egyptian Educational Bureau, Washington, D.C.

NEALE, MERRITT ALDRICH (Age 24) Instructor, Dept. of Civ. Eng., Carnegie Inst. of Technology, Pittsburgh, Pa.

OSTERMAN, JOSEPH GEORGE (Age 27) B.S.C.E., Univ. of Wisconsin (Sept. 1947), Cudahy, Wis.

PATEL, OCHHAVLAL HIMATLAL (Age 22) Graduate Student in Civ. Eng., Iowa State Coll., Ames, Iowa.

SPILLER, JO RICE, JR. (Age 27) Office Engr., Howe & Wise, Cons. Engrs., Houston, Tex.

THANMAVARATHER, SANGARAPILLAI (Age 25) Postgraduate Apprentice, Messrs. Howard Humphreys & Sons, Cons. Engrs., London, England.

ALA. POL. INST.

	Age
SCHUTZ, FREDERICK WILLIAM, JR., 1947	(26)

UNIV. OF ALA.

MAISEL, MURRY, 1947	(21)
THROPP, HAROLD IRWIN, 1947	(24)

CLARKSON COLL. TECH.

CLEMENTE, ROCCO FRANCIS, 1947	(26)
EMERSON, CARL ARTHUR, 1947	(24)
GRABOW, ROBERT LEWIS, 1947	(21)
HATCH, GEORGE FREDERICK, 1947	(26)
JONES, WARREN LATTIMER, JR., 1947	(25)
KAPLAN, STANLEY B., 1947	(21)
TOLOSKY, JOSEPH ROYCE, 1947	(25)
WHALEN, RAYMOND JOSEPH, 1947	(24)

UNIV. OF CALIF.

REPLOGLE, CARL SILVIUS, JR., 1947	(26)
SNIDER, GLENN GRAYDON, 1947	(23)
SPIKER, JOHN WESLEY, 1947	(23)

UNIV. OF COLO.

CARLSON, DEVON MCEVIN, 1947	(29)
FADEL, ALY, 1947	(28)
HANAHAN, THOMAS DAVANT, 1947	(21)
NOWOWIEJSKI, ALFRED JOSEPH, 1947	(23)
SIVERS, WENDELL CLIFFORD, 1947	(23)
WILLIAMS, HOUSTON GARVIN, 1947	(24)

CORNELL UNIV.

MAHLER, RUSSELL WINSLOW, 1947	(23)
WOOD, ALFRED JOHN, 1946	(22)

DREXEL INST. TECH.

MARTIN, NORMAN HERBERT, 1947	(24)
SLACUM, RICHARD STRATTON, 1947	(26)

DUKE UNIV.

BROCKWAY, GEORGE LEMUEL, JR., 1946	(24)

ILL. INST. TECH.

DAMEWOOD, IVAN JAY, 1947	(27)

UNIV. OF ILL.

ALEXANDER, GEORGE LEROY, JR., 1947	(24)
BOHNE, LESTER WILLIAM, 1947	(24)
BUCKMAN, ROBERT CHARLES, 1947	(24)
CRAIN, RALPH WARREN, 1947	(24)
ERDOGAN, SEYFI, 1947	(20)
HALSEY, JAMES FREDERIC, 1947	(27)
JONES, LLOYD WALTON, 1946	(24)
KAITIS, FLORIAN ADAM, 1947	(24)
LONGHELT, HERBERT FREDRICK, 1947	(24)
MIDDLETON, JOSEPH LANE, 1947	(24)
MOTTIER, CHARLES HELVETIUS, JR., 1947	(23)
OEHLERT, FREDRICK WILLIAM, 1947	(22)
RANDALL, PRYOR NEIL, 1942 (at present graduate student)	(27)
ROSCHE, MELVIN GRADEN, 1947	(26)

STATE UNIV. OF IOWA

BAUER, WILLIAM JOHN, 1947	(24)

KANS. STATE COLL.

ROBOHN, WALTER FREDERICK, 1947	(29)

LEHIGH UNIV.

BLEUL, GEORGE JOHN, 1947	(25)
SLABY, FRANK JOHN, 1947	(24)

UNIV. OF LOUISVILLE

AINSLIE, GEORGE WARREN, JR., 1947	(23)

MASS. INST. TECH.

KNAPP, NORMAN TINKLER, 1947 (25)

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SILER, WILLIAM CRACRAFT, 1947 (23)
WOESTENDIEK, EUGENE CHARLES, 1947 (21)
WYRUCHOWSKI, EDWARD PETER, JR., 1947 (25)

UNIV. OF MICH.

DE LEON, RICARDO PARAS, 1947 (25)

UNIV. OF MINN.

GRANT, JAMES CLAYTON, 1947 (28)
LEE, HWA-NI, 1947 (24)
ZIEMKE, NORMAN ROBERT, 1947 (26)

UNIV. OF MO.

BAKER, WALTER FRANKLIN, 1947 (23)
CRAYTON, MAXWELL SLOAN, 1947 (22)
GUINN, EDWARD WRIGHT, 1947 (25)
HERZOG, WILLIAM E., 1947 (27)
LLOYD, ROBERT FILLEDES, 1947 (25)
STENDER, LOUIS ALBERT, 1947 (23)

UNIV. OF NEBR.

JENSEN, JAMES BRUCE, 1947 (29)

N. MEX. STATE COLL.

BOISE, CHARLES LUCAS, 1947 (26)

COLL. OF CITY OF N.Y.

GRANEK, PAUL, 1947 (27)
LEVY, BENJAMIN, 1947 (28)
SCHWARTZ, NATHANIEL EPHRAIM, 1947 (22)

UNIV. OF N.DAK.

MARTIN, LEO RAYMOND, 1947 (26)

UNIV. OF NOTRE DAME

SAMSON, CHARLES HAROLD, JR., 1947 (23)

NORTHWESTERN TECH. INST.

BORNHOEFT, JACK HARRY, 1947 (24)
BROWN, ROBERT FLETCHER, 1947 (24)

UNIV. OF OKLA.

KERR, BETTY JO, 1947 (21)

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FLOYD, ARCHIE EDWARD, 1947 (23)
GRASS, ROBERT WILSON, 1947 (22)

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KUDZMA, STANLEY CHARLES, 1947 (24)

ROSE POL. INST.

DUWELIUS, THOMAS ARNOLD, 1947 (23)

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BAKER, FRED HESTWOOD (26)

UNIV. OF SO. CALIF.

DRYER, VELEIT YOUNG, JR., 1947 (26)
HENNESSY, PAUL VINCENT, 1947 (26)
YOUNG, ROBERT EDWARD, 1947 (24)

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KEMBLE, JOE ROY, 1947 (27)

UNIV. OF TEXAS

CORREA Y REYES, JOSE JESUS, 1947 (26)
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OLSON, ROBERT MERLE, 1947 (23)
POBST, DAVID FRANK, JR., 1947 (22)
SHIMEK, CARL LESTER, 1947 (24)
SIMONS, WILLIAM LAWRENCE, 1947 (24)
VAN ZEE, ELBERT FORD, 1947 (23)

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BANKHEAD, REID ELWOOD, 1947 (28)
HOGGATT, HOWARD GENE, 1947 (26)

VANDERBILT UNIV.

NORRIS, PELHAM NEAL, 1947 (25)

VA. POL. INST.

CROPPER, JOHN RAYNE, JR., 1947 (23)
DEARING, HENRY EARL, 1947 (25)

WASHINGTON UNIV.

ROTH, LAWRENCE PHILIP, 1947 (26)

UNIV. OF WASH.

BRYANT, HARRY EDWARDS, 1947 (26)
CORWIN, WILLIAM CRAFT, 1947 (25)
HAGESTAD, HAROLD ARTHUR, 1947 (27)
HILL, HARRY LEIGH, 1947 (24)
OTT, CHARLES RAYMOND, 1947 (26)
PETITJEAN, LELAND STANFORD, 1947 (26)
POWELL, EARL LEHR, JR., 1947 (26)
ROE, HAROLD KIRBY, 1947 (22)
WAGNER, PHILIP CARL, 1947 (30)

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

CHANGES IN MEMBERSHIP GRADES

ADDITIONS, TRANSFERS, REINSTATEMENTS, AND RESIGNATIONS

(From October 10 to November 9, 1947)

Additions to Membership

ALDOM, ROBERT SADLER (Jun. '47) 80 Westover Ave., Caldwell, N.J.

AXELSON, JOHN ALBERT (Jun. '47) Asst. Engr., Osborne-McMillan Elevator Co., 610 Grain Exchange Bldg. (Res., 601 Sixth St., S.E.), Minneapolis, Minn.

BARR, ELMER EDWARD (Jun. '47) Industrial Engr., Carnegie-Illinois Steel Corp., McDonald Mills, McDonald (Res., 45 East Main St., Canfield), Ohio.

BARNES, ALBERT HASBROUCK (Jun. '47) Instr., Case Inst. of Technology, Cleveland (Res., 1262 East 142d St., East Cleveland 12), Ohio.

BARRETT, WALTER RALPH (Jun. '47) 1533 3/4 Sixth Ave., Los Angeles 6, Calif.

BARTON, RICHARD ALAN (Jun. '47) Asst. Instr. in Civ. Eng., Univ. of Missouri (Res., 2 Woodson Way), Columbia, Mo.

BASCOM, MANSFIELD M. (Jun. '47) Asst. Instr., Yale Univ., Winchester Hall, New Haven (Res., 37 Hartley St., Hamden), Conn.

BILBY, JOHN EDMUND (Jun. '47) Res. Engr., Black & Veatch, Cons. Engrs., 4706 Broadway, Kansas City (Res., Brown's Station), Mo.

BORNHOFT, ARLIE (Jun. '47) Senior Eng. Aide (Civ.), City Engineering Dept., County City Bldg. (Res., 614—14th North), Seattle 2, Wash.

BOSWELL, HOWARD LEONARD (Jun. '47) Engr., Boswell Eng. Co. (Res., 6 Morningside Lane), Ridgefield Park, N.J.

BREWER, PHILIP WARREN (Jun. '47) Designer, Washington Suburban San. Comm., Hyattsville, Md. (Res., 1809 G St., N.W., Apt. 708, Washington 6, D.C.)

BRONSON, GORDON (Jun. '47) Constr. Engr., John J. Wise & Co., Inc., 67 West 44th St., New York, N.Y. (Res., 602 Fifth Ave., Asbury Park, N.J.)

BRUNO, PAULINE ANNE (Miss) (Jun. '47) Road Draftsman, State of Rhode Island, State Office Bldg., Providence (Res., 159 High St., Bristol), R.I.

BUETTNER, PAUL EDWARD, JR. (Jun. '47) Carpenter (apprentice), Henry Stock & Son, Gen. Contrs., 30 North Ludlow St. (Res., 605 Rockford Ave.), Dayton 5, Ohio.

CHADWELL, HARRIS JESSE (Jun. '47) Constr. Engr., E. B. Badger & Son, Inc., Box 905, Baytown (Res., 108 West Humble St., Goose Creek), Tex.

CHRISTENSEN, HOWARD ORVAL (Jun. '47) Prin. Draftsman (Structural), Pacific Islands Engrs., Station No. 10, Guam.

CLARKE, CHARLES BERNARD (Assoc. M. '47) Special Research Associate, Univ. of Illinois, 108 Talbot Laboratory, Urbana, Ill.

CORASANITI, JOSEPH VICTOR (Jun. '47) Gen. Contr., Trinity Building and Constr. Co., 908 Trinity St. (Res., 6205 Tramore Road), Baltimore, Md.

CUMMINGS, EDWARD MORRILL (Jun. '47) Engr., Aetna Casualty & Surety Co., 1200 Main St., Springfield (Res., Shady Elm Farm, Granby), Mass.

CURTIS, BENJAMIN TALMADGE (Jun. '47) 432 South 42d St., Philadelphia 4, Pa.

DA COSTA, OSCAR MACHADO (M. '47) Chf. Engr., Servico de Reforco de Pontes, Porto Amazonas, Parana (Res., Ladeiro do Ascurra, 94, Rio de Janeiro), Brazil.

DANNER, CHARLES STEELMAN (Jun. '47) Instr., Dept. of Civ. Eng., Univ. of Illinois, Urbana, Ill.

DAVIS, RICHARD ORTON (Jun. '47) Junior Engr., Burns & McDonnell Eng. Co., Box 7088 Country Club Station (Res., 1205 East 66th Terrace), Kansas City 5, Mo.

DE PIERRO, JOHN JOSEPH (Jun. '47) Asst. Engr., S. V. Defazio Cont. Co., 592 Garfield St. (Res., 228 South Pine St.), Hazleton, Pa.

DIAMOND, WILLIAM HOWARD (Assoc. M. '47) Senior Structural Designer, U. S. Atkins & Partners, Cons. Engrs., 158 Victoria St., London, S. W. 1, England.

DONNELL, ALTON PARKER (Assoc. M. '47) Maj., Corps of Engrs. Atomic Energy Comm., 1901 Constitution Ave., N.W., Washington, D.C. (Res., 6443 Fairfax Rd., Chevy Chase 15, Md.)

DOUGHERTY, CHARLES NELSON (Jun. '47) Draftsman, C. C. Cohagen, Archt., 211 Hedden Bldg., Billings, Mont.

DUROW, LLOYD CHARLES (Jun. '47) Supt. of Bldgs. and Grounds, Washburn Municipal Univ. of Topeka, Topeka, Kans.

FALTUS, FRANTISEK (M. '47) Prof., Technical Univ., 13 Trojanova, Praha II, Czechoslovakia.

FARRELL, JOSEPH ROMULUS, JR. (Assoc. M. '47) Vice-Pres. in charge of Constr., Joseph R. Farrell, Inc., 4424 Market St., Philadelphia 4, Pa.

FATHAUER, JACK ELMER (Jun. '47) Test Engr., National Malleable & Steel Castings Co., 10600 Quincy Ave. (Res., 561 East 110th St., Apt. 3), Cleveland, Ohio.

FEIDEN, ELLIOTT (Jun. '47) Structural Designer Seelye, Stevenson & Value, 101 Park Ave. (Res., 3 East 54th St.), New York, N.Y.

FIELD, STANTON MCNEAL (Assoc. M. '47) City Engr., City of Amarillo, City Hall, Box 1971 (Res., Box 2285), Amarillo, Tex.

FIELDER, WALTER GEORGE (M. '47) Civ. and Hydr. Engr., Central New York Power Corp., 300 Erie Blvd., West (Res., 716 Salt Springs Road), Syracuse 3, N.Y.

FLETCHER, RAYMOND FRANCIS (M. '47) Senior Architectural and Civ. Engr., E. I. du Pont de Nemours & Co., Care, Eng. Dept., Wilmington, Del.

FOLWELL, WILLIAM HOPKINS (Jun. '47) Engr.-Detailer, Sheffield-Briggs Steel Products Co., 7230 North West 2nd Ave. (Res., 1945 North West 24th Court), Miami 35, Fla.

FOSS, EDWARD ROBERT, JR. (Jun. '47) Highway Engr., Creole Petroleum Corp., Care, Highway Eng. Dept., Caracas, Venezuela.

FRANK, BEN (Jun. '47) Layout Engr., Walco Eng. & Constr. Co., Geneseo, Ill.

FREEMAN, LEWIS DEWITT, JR. (Jun. '47) Eng. Apprentice, Pennsylvania R.R. Co., Union Station, Room 405, Washington, D.C. (Res., Apt. 227, Arlington Village, Arlington, Va.)

FUCHS, PAUL (Jun. '47) Civ. Engr., Chicago, Burlington & Quincy R.R., 547 West Jackson (Res., 1331 South Sawyer), Chicago, Ill.

GANNON, JOHN JOSEPH (Jun. '47) Junior San. Engr. Manhattan College Stream Pollution Research Project, Manhattan College (Care, C. J. Velz) (Res., 665 Oakland Place), New York 57, N.Y.

GARB, HAROLD (Jun. '47) Junior Civ. Engr., Madigan-Hyland, 28-04 Forty-first Ave., Long Island City (Res., 2705 Bainbridge Ave., New York 58), N.Y.

GEARY, WILLIAM JAMES (Jun. '47) Care, Lock Joint Pipe Co., Ciudad Trujillo, Republica Dominicana.

GOEPFERT, BENJAMIN LEROY (Jun. '47) Graduate Student, Univ. of Illinois, 201 Eng. Hall, Urbana (Res., 506 South McKinley, Champaign), Ill.

GOLDMAN, WILLIAM MORRIS (Jun. '47) Engr. in training, "Automatic" Sprinkler Corp. of America, Youngstown (Res., 74 Sexton St., Struthers), Ohio.

GOVERN, EDWARD JAMES (Assoc. M. '47) Engr., Corps of Engrs., War Dept., N.Y. Dist., 120 Wall

JAMISON, WILLIAM HENRY (Jun. '47) Estimator

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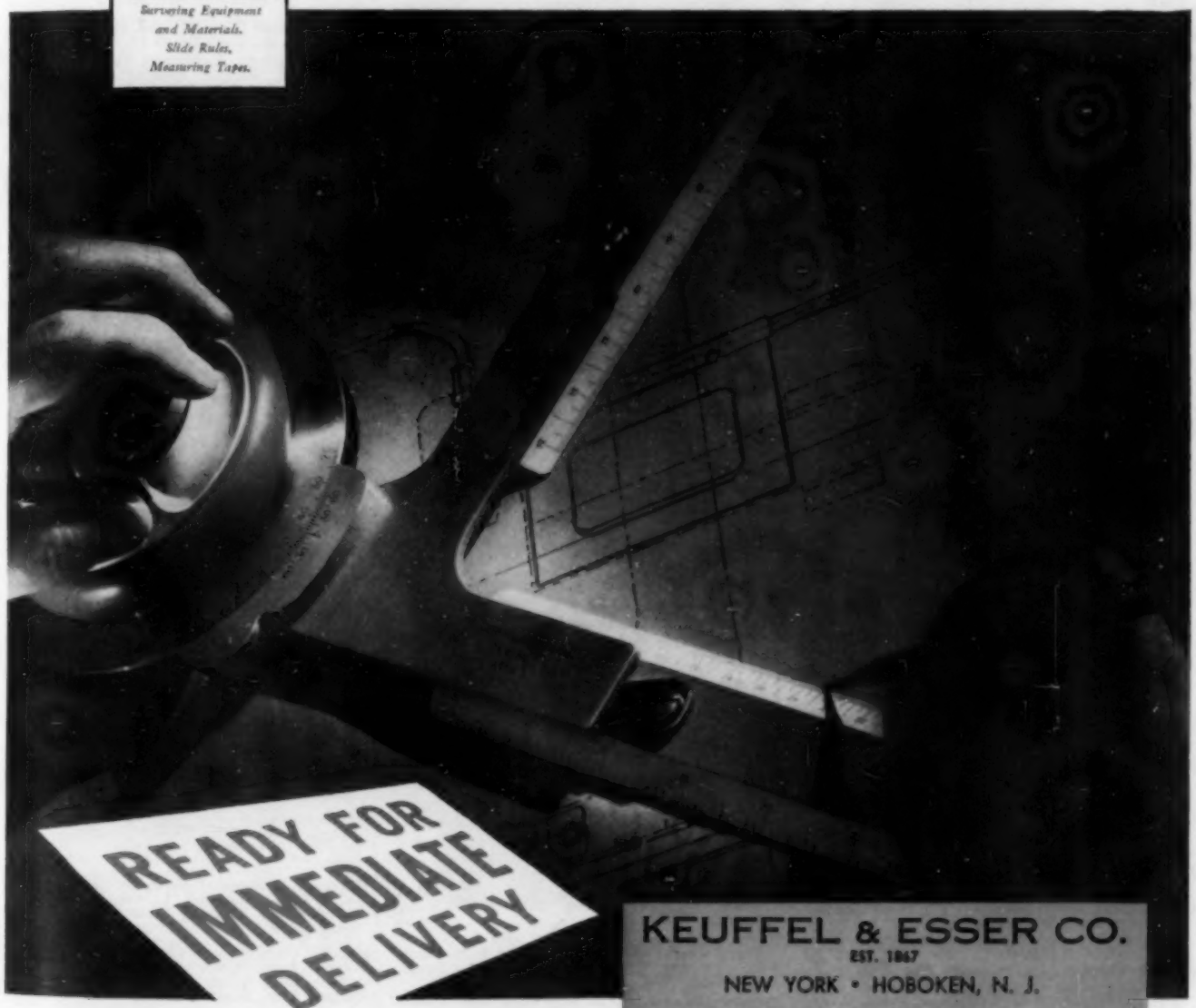

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GARNETT, BENJAMIN JAY, M., Bridge Engr., City Engr's. Office, City of Spokane, 401 City Hall, Spokane, Wash., reinstated Oct. 27, 1947.

JONES, CARLTON WALTER, Assoc. M., Engr., H M. Wilson Co., Engrs., Care, P. H. Glatfelter Co., Spring Grove, Pa., reinstated Oct. 6, 1947

LAGARDE, PAUL MICHINARD, Jun., Asst. Chf. Engr., New Orleans Public Belt R.R., City Hall Annex (Res., 38 Davis Blvd.), New Orleans 20, La., reinstated Oct. 23, 1947.

LAWSON, DAVID, Assoc. M., Cons. Engr., 111 Montague St., Brooklyn 2, N.Y., reinstated Oct. 9, 1947.

MCCOY, JOHN DAVID, Assoc. M., Engr., Bureau of Reclamation, P.O. Box 605, St. George, Utah, reinstated Oct. 10, 1947.

NONES, ADOLFO, M., Cons. and Constr. Engr.-Mgr., Box 1311, Ponce, Puerto Rico, reinstated Oct. 10, 1947.

SELLS, CHARLES HARVEY, M., Supt. of Public Works, State Dept. of Public Works, State Office Bldg., Albany 1, N.Y., readmitted Sept. 8, 1947.

TRAINOR, CHARLES FRANKLIN, M., Tech. Asst. to Dist. Engr., also Chf. Eng. Div., Corps of Engrs., Savannah Dist., Post Office Bldg. (Res., 539 East 57th St.), Savannah, Ga., readmitted Oct. 20, 1947.

VON ZUBEN, FRANCIS JOSEPH, Assoc. M., Cons. and Superv. Engr., 1606 Mistletoe Blvd., Fort Worth, Tex., reinstated Oct. 15, 1947.

WALKER, JOHN BEN, M., Head Engr., Army Engrs., War Dept., 2 New York Ave., N.W., Washington, D.C., reinstated Oct. 10, 1947.

WALL, HARRY BOYKIN, Assoc. M., Engr. Representative, U.S. Fidelity & Guaranty Co., 317 West 2d St., Little Rock, Ark., reinstated Oct. 24, 1947.

Resignations

BRASLOW, BARNETT, M., 165-11 Union Turnpike, Flushing, N.Y., resigned Oct. 7, 1947.

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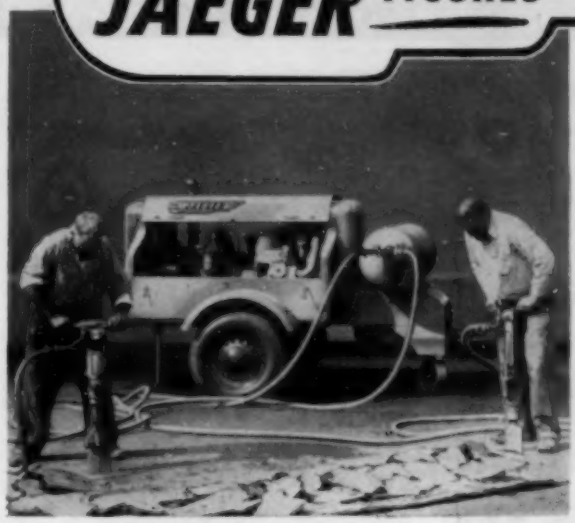

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Root Universal Joint

EQUIPMENT, MATERIALS *and Methods*

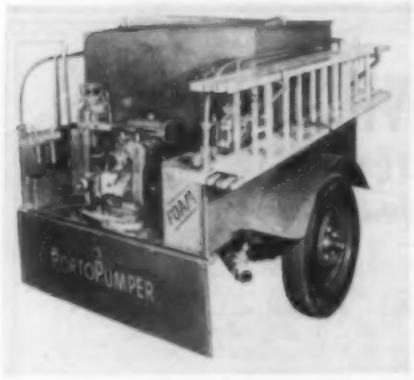
NEW DEVELOPMENTS OF INTEREST, AS REPORTED BY MANUFACTURERS

New Building Material

DANT & RUSSELL have recently developed a building material called Dantore. This lightweight material is "popped" by intense heat from raw perlite ore, and is used to replace the sand in plaster. Dantore weighs only 12 lb per cu ft as compared with sand's weight of 85 lb per cu ft. Besides the tremendous reduction in weight, plaster containing Dantore is said to resist checking and cracking common in houses which have settled even slightly. Dantore also offers insulation against heat, cold and noise.

The ore used is extracted from a mountain of volcanic glass located in Central Oregon. The ore is crushed, ground and screened at the mine, and "popped" at the Dant & Russell plant at St. Helens, Ore. At the present time, there are three marketed products made from Dantore: lightweight plaster aggregate, acoustical plaster, and ready-to-use hardwall plaster. Research is under way to discover other uses for this lightweight, fireproof, termite-proof material.

Fire-Fighting Trailer



THE NEW "CAMEL," an optional model of the Porto-Pumper fire-fighting trailer, is announced by the manufacturer, Porto-Pump, Inc., Detroit, Mich. The "Camel" model carries the same basic equipment as the standard Porto-Pumper: demountable, independent-powered, 85-lb high-pressure utility Porto-Pump; 50 ft of supply hose, 200 ft of fire hose; 18-ft, 3-section extension ladder; fire axe and hand extinguisher; a selection of nozzles and hydrant adapters, and the added feature of a 200-gal tank. As with the standard model, the "Camel" takes water from any source, but the addition of the tank makes it possible to fight fire away from any water source.

New equipment offered in addition to the tank includes the latest type nozzles for foam producing and fog nozzles which can be used where water vapor protection is desirable. Municipalities may make use of the Porto-Pumper for spraying and weed control operations.

Newly Designed Bulldozer

A NEWLY DESIGNED bulldozer recently tested with pilot models is being introduced by the Wm. Bros Boiler & Mfg. Co., Minneapolis, Minn. The Bros Power-Plus line of dozers, both straight and angle, available now for D4 and D6 Caterpillar tractors, incorporates the famous "fluid power control" provided by the LaPlant-Choate hydraulic pump. The LaPlant-Choate Co. has cooperated with Bros engineers in designing the new Power-Plus line with the hydraulic system that combines pump, valve and oil reservoir into a single unit.

The D4 models, which have positive down pressure, are track-mounted, direct-lift, double-acting hydraulic bulldozers with full-floating trunnion rams. The D6 dozer, which is frame mounted, incorporates the new compact pump with a minimum of hydraulic piping. A rigid frame with floating moldboard incorporates the following advantages: great strength, offset pivot pin for clearance, easy removal of main frame and blade, reversible cutting edge, correct and proved blade curvature. D4 units can be front or rear mounted. D6 units are front mounted only. The new line of Power-Plus dozers will be handled through Bros, LaPlant-Choate and Caterpillar dealers.

Dual Control

DUAL CONTROL, a new feature announced by The Thew Shovel Co., Lorain, Ohio, may be installed on any Lorain Model TL-20 which is mounted on a standard 4 × 4, 6 × 4, or 6 × 6 rubber-tire Moto-Crane carrier. The machine will travel up to 33 miles per hr and can be converted in five minutes into a self-propelled unit powered by the turntable engine only. All steering and brake controls are located conveniently at the operator's position in the turntable cab. Steering is controlled by air power. Dual control is recommended by The Thew Shovel Co. for those applications where localized mobility and one-man operation on the job, combined with high-speed travel between jobs, will result in the maximum use of the crane at the lowest cost.

Socketype Cable Terminals

MACWHYTE COMPANY of Kenosha, Wis., manufactures "Socketype" terminals consisting of an alloy steel cadmium plate eye or fork type fitting plus a stainless steel sleeve for swaging to cable (wire rope). These terminals have been approved by the Civil Aeronautics Administration for use at 100 percent of the rated strength of the cable to which they are properly attached. Advantages attributed to these terminals are: saving of cable; permitting cable to swivel freely when load-free, thus eliminating kinking; and providing a safe, smooth, foul-free installation.

High Discharge Truck Mixer

BLAW-KNOX COMPANY, Blawnox, Pa., announces production of the Hi-Boy Truk-mixer. A unique feature of the new high-discharge machine is a revolving hopper for both charging and discharge. This permits a gadget-free and stream-lined rear end, with advantages in operation and savings in maintenance. The hopper is supported directly from the end of the mixing drum cone and moves with the drum as the truck frame weaves under field-operating conditions. This integrated design of the Hi-Boy assures a tight and enduring seal between hopper and drum. While charging, the hopper is held in upright position by a simple latch. When the operator wishes to discharge, he opens the latch which permits the hopper to rotate 180 deg with the drum.

The freedom from gadgets at the discharge end of the mixer permits maximum approach to a concrete bucket or a concrete hopper. A quick opening and closing inspection hatch is provided, and it is made leakproof by a rubber seal. A thorough job of mixing and uniform mix from beginning to end of the batch are claimed for the unit. It is reported to discharge rapidly without segregation and will satisfactorily discharge low slump concrete. It is made in standard sizes of 2, 3 and $4\frac{1}{2}$ cu yd.

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Root Universal Joint

THE CONSTRUCTION of the Root Universal Joint features several new or improved points of design. The joint works with a "ball-and-socket" action similar to a toggle joint. The stress of transmitting power through the angular range of joint deflection is absorbed by two oversize keys. This provides a margin of strength at the point where failure of universal joints is most likely to occur. The socket provides a natural oil reservoir for retaining oil and the bearing surfaces are lubricated by capillary action. There are five parts which are held in place by a spun cap with rolled edge. All parts are machined to close tolerances, wearing surfaces are hardened, and the outside diameter of the joint is small in relation to the size of the shaft it will turn.

B. M. Root Company of York, Pa., offers a bulletin giving size designations and features of the joint.

Vibroflotation Unit

THE UNIQUE "vibroflotation" unit manufactured by the Baldwin Locomotive Works, Eddystone, Pa., in cooperation with SKF Industries, Inc., General Electric and others, is a mechanism which can pack loose particles of soil or sand so tightly that they will support building foundations, water-retaining dams and heavy airport runways.

A shaft with an unbalanced weight revolves at 1800 revolutions per minute thus setting up the necessary vibrations. The cylindrical unit, with the aid of powerful water jets, can pack a 100-sq ft area of soil to any required depth up to 100 ft into a solid mass at each application.

Permanent Non-Electric Pulley

A COMPLETELY self-energized magnetic pulley requiring no electric current to generate a magnetic field is now being commercially produced by Eriez Manufacturing Company, Erie, Pa. This pulley is adaptable to all applications requiring automatic separation of magnetic from non-magnetic materials or removal of tramp iron from coal, ores, grains, textile fibers, chemicals, foundry sand, etc., conveyed on a belt. The unit will work effectively through belts of rubber, canvas, leather or any other non-magnetic material, thereby performing automatic separation.

Powered by giant Eriez Alnico alloy magnets, these non-electric pulleys have been placed in a variety of industries throughout the United States, often in hazardous locations where possible sparking has precluded the use of electrically powered separators. Since moisture, heat or cold will not affect its operating efficiency, the Eriez Pulley may be installed outdoors, deep in a mine or at any point where direct current is not available. Since the permanent strength is not affected by electric current variations, these non-electric pulleys always operate at top efficiency.

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FOR CANADA'S GREAT
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—Twelve miles from Sudbury, Canada in the heart of the rich nickel mining area, two newly completed Layne Well Units are now producing over 3,000 Imperial Gallons of Water per Minute. Started in weather 30 degrees below zero, the two wells were drilled, equipped, tested and delivered without delay. Both wells are electric motor powered and are providing water for the mines and for the townsite. Ore from these mines is shipped to Norway for refining.

Layne Well Water Systems are widely used throughout Canada, serving cities, mines, paper pulp mills, air fields and army camps. As is the case elsewhere, these Canadian installations are highly efficient, produce large quantities of water and are exceptionally dependable in all kinds of weather.

For late literature, catalogs, bulletins, etc., address: LAYNE & BOWLER, INC., General Offices, Memphis 8, Tenn.

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Air Diffusion Tube

THE CHICAGO PUMP COMPANY, 2373 Walfram St., Chicago, Ill., has recently announced the development of a new type of air diffusion tube for use in the Activated Sludge Process of sewage treatment and in air diffusion and gas mixing for the chemical process industries. The tube, made of corrugated stainless steel and mechanically wound with Saran plastic cord, is 60 percent lighter than previous diffusion media. Its construction makes it exceptionally strong, with safety factors beyond any stresses to which tubes would be subjected in use or handling. Because of its relative lightness compared to previous tubes, it allows a more economical application of the Swing Diffuser equipment.

Thin-wall construction (one-sixth wall depth of previous tubes) reduces depth clogging and provides for quicker and more effective cleaning. Precise uniformity of fine-bubbled diffusion from entire active surface of the diffuser at all air-rates results in lower head loss at all air-rates, greater surface area of tube diffusing at all rates, and the entire surface active at maximum rates. Cleaned tubes are restored to original performance, i.e., no progressive clogging.

Acoustical Unit

A NEW METAL PAN acoustical unit for use in buildings requiring a permanently incombustible noise quieting and acoustical treatment has been developed by the Building Materials Division of the Armstrong Cork Company, Lancaster, Pa. Called Arrestone, the new unit is a perforated metal pan containing a flameproof paper-wrapped mineral wool sound absorbing pad which is held away from the perforated surface with a metal grid. Arrestone's reputed noise-reduction coefficient is 0.85. The sound-absorbing efficiency is as high as 0.99 for sounds originating at 512 and 1024 cycles. In addition, the mineral wool pad also provides thermal insulation.

Since Arrestone weighs only 2 lb. per sq ft, it is highly suitable for suspended installation to conceal piping, air-conditioning ducts, wiring, etc.

J-10 Utility Jackhamer

A NEW AIR-OPERATED drill, designed and built for general utility and plant maintenance work, has been announced by Ingersoll-Rand Company of Phillipsburg, N.J. Called the J-10 Jackhamer, the drill is said to offer the following advantages and features: easy handling because of its light weight; strong automatic rotation; a built-in reservoir in the handle, supplying ample lubrication; and throttled control permitting the selection of exactly the right kind of blow for any type of work.

The drill may be used by maintenance crews, plumbers, electricians, construction crews, millwrights and many other types of workers.

Hydraulic Gear Pumps

TWO NEW HYDRAULIC gear pumps, models 9000 and 9075, are announced by The Aro Equipment Corporation, Bryan, Ohio. These pumps have been developed for continuous service up to 1000 psi, and for intermittent service at pressures up to 1500 psi. They are built to precision standards, to assure high efficiency at high pressures and for long, continuous operation. They are simple in design, employing a minimum of moving parts. Wear-resisting materials are used, and the pumps can be directly driven or used with belt, gear or chain drives.

Motor-Feed Wagon Drill

GARDNER-DENVER COMPANY of Quincy, Ill., announces its new URM Motor Feed Wagon Drill. According to company engineers, this new wagon drill assures high-speed performance in all kinds of ground, ranging from hard, solid formations to soft and broken ones. The new wagon drill has a 3-wheel Universal mounting with motor feed for 6-ft steel changes. The motor feed is operated by a powerful 5-cylinder radial air motor driving a chain attached to a heavy mounting slide carrying the drill. The URM carries a $3^1/_2$-in. or 4-in. bore derrick drill.

One of the outstanding features of the new drill is its ease of control. The feed can be reversed instantly for effective churning and the correct feed pressure is maintained by means of a regulating valve. A single throttle handle controls drill operations. Faster hole-cleaning is assured by the fact that drills used on the URM wagon have an air-actuated exhaust control valve operated by the drill throttle handle. Designed for wide flexibility of use, the U-bar of the URM is adjustable from a position slightly above horizontal through an arc of 90 deg to one practically vertical. The large wheels are adjustable to 90 deg for line drilling. Equipped with pneumatic tires, the URM is easily moved over rough ground.

Dual Shale Shaker

A NEW LINK-BELT Dual Mud Screen (Shale Shaker), size 36 in. × 48 in., Type NRM-134, Model 45, completely unitized, readily transportable, for reconditioning drilling mud on shallow, medium or deep oilwell drilling work, is announced by Link-Belt Company, Chicago, as being the strongest, most efficient mud-cleaning vibrating screen unit that the company has ever built. The complete self-contained unit includes two 36-in. wide × 48-in. long vibrating screens driven individually by V-belts from a single electric motor, steam turbine, gas or diesel engine; a built-in mud receiving box; a screened-mud collecting outlet or trough connection on either or both sides of unit; and rugged, conveniently handled steel skids on which everything is compactly mounted.

This mud screen is featured in a new illustrated Folder No. 2229, containing further details, including operating instructions and a replacement parts price list.

This will accomplish jobs requiring

80,000 FEET OF 4" PIPE!

One of our customers was stumped for immediate delivery of 5,000 feet of 4" pipe—a problem you can doubtlessly appreciate. His problem was solved *without delay, at lower cost and with many advantages over steel pipe!*

We still have available FOR IMMEDIATE DELIVERY 80,000 feet of NEOPRENE NAVY SUCTION HOSE. This material, made as oil suction and discharge hose to strict Navy specifications 33-A-4P, operates at 150 lbs. pressure. (Bursting pressure in laboratory tests was 600 lbs.)

Specifications: 4" I.D., with round wire reinforcement in $^1/_{10}$th jacket, 4-ply Neoprene. Stiffened with flat steel wire. In 10 ft. and 30 ft. lengths. 4" Standard pipe nipples vulcanized in each end and complete with brass couplings, Male and Female screwed on each end. 30 ft. lengths actually measure 31½ feet.

This is HIGH QUALITY OIL HOSE listing normally at $5.50 ft. and is being used successfully for: *WATER LINES * OIL AND GASOLINE LINES * AIR AND GAS LINES *.

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Literature Available

ENGINEERING PROGRESS AND YOU—Ben Nicholson Co., Seattle, Wash., presents a folder entitled, "Engineering Progress and You." The folder discusses the newly developed machine which uses an air jet to pack joints quickly and tightly with grout. An article written by C. S. Seabrook, Sewer Engineer, Dept. of Public Works, Tacoma, Wash., explains the use made of the machine in the construction of a 54-in. trunk sewer built in Tacoma. Pictures and specifications are also given in the folder.

PROPANE-BUTANE HOSE—Stressing its suitability for handling highly volatile petroleum gases in liquefied form from bulk storage to tank car and from tank car to home storage tanks, Hewitt Rubber Division, Hewitt-Robins, Inc., Buffalo, N.Y., has released a new descriptive folder on Monarch propane-butane hose. Design, construction, uses and safety features are explained thoroughly in the new folder.

NEW SPECIFICATION SHEETS—American Tractor Equipment Corporation announces the publication of new specification sheets on their lines of landleveling scrapers, bulldozers, roadbuilders and hydraulic P.V.T. assemblies. The sheets contain photographs of the equipment, as well as detailed information on construction and operating features. Copies may be obtained from ATECO, 9131 San Leandro Blvd., Oakland 3, Calif.

POINTED WELLPINT FACTS—Publication of a new catalog, "Griffin Pointed Wellpoint Facts," is announced by Griffin Wellpoint Corporation, New York 54, N.Y. This catalog contains latest information and photographs of Griffin Wellpoint Systems for dewatering, emergency and permanent water supply systems. Included are six pages of data on Jetting Pumps with on-the-job illustrations.

NEW TANDEM ROLLER—The Wheeler Tandem Roller Division of Shaw Sales & Service Co., Los Angeles, Calif., announces an illustrated 6-page, 2-color folder describing the Wheeler 3- to 4-ton Tandem roller. Outstanding features listed are: better visibility, quick, easy steering, single lever clutch, choice of engines, gravity sprinkler, heavy-duty frame, foot brake, two-way roller scrapers, Timken roller bearings, machine-finished rollers, water-weighted rollers, high side clearance, low center of gravity, geared-bull wheel, and close side clearance.

THERMAL INSULATION—Of interest to architects, engineers, builders, supply houses, applicators and home owners is the new 16-page illustrated booklet, "Simplified Physics of Thermal Insulation." It explains the entire theory of every type insulation, and contains a valuable chart showing k, c, r and u factors of all insulations, including mineral, other fibrous insulations and reflective types of all thicknesses. Weights, densities, cubic foot contents and other factual data are also given. The booklet may be obtained by writing to Infra Insulation, Inc., 10 Murray St., New York, N.Y.

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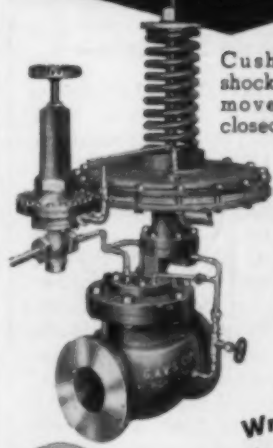

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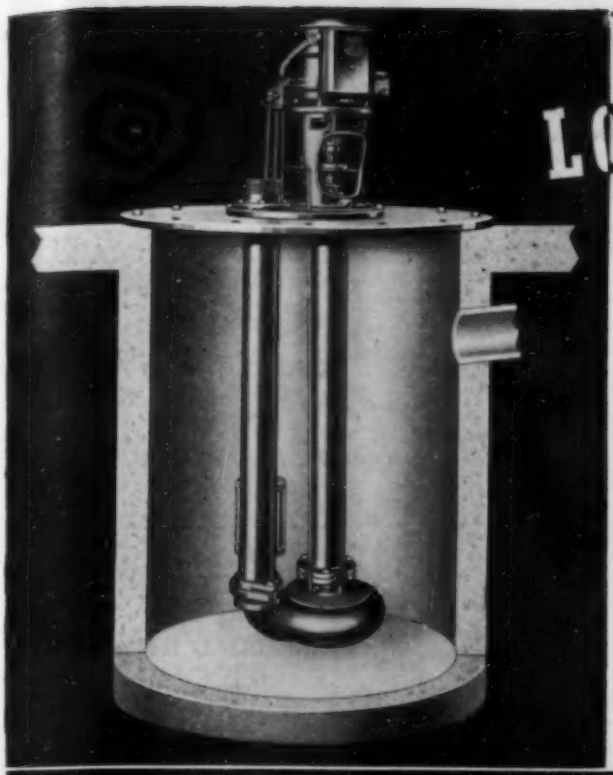

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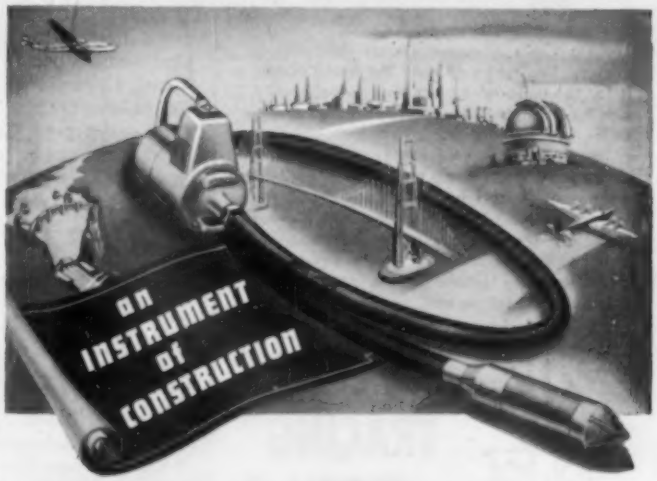


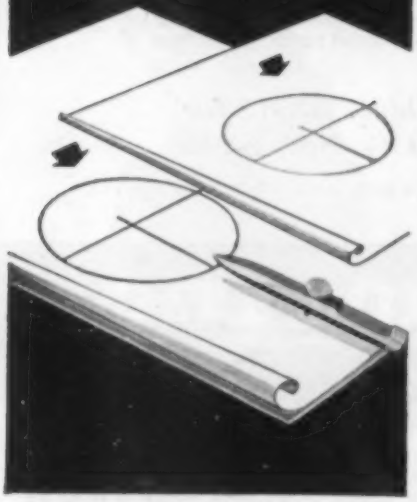
ENGINEERS AND CONSTRUCTION MEN AGREE
VIBER VIBRATORS REDUCE CONSTRUCTION TIME AND COST!

To obtain maximum density and strength in concrete, it is important that the entire mix be given internal high speed vibration. This reduces voids, honeycombs, shrinking and cracking, also placing and compaction time. Built to withstand the strain on heavy construction jobs, the VIBER Vibrator makes practical the use of drier mixes. The interchangeability of VIBER units permits quick conversion to changing job conditions, eliminating delays, and the light weight portability offers easy one-man operation.

Important facts and specifications on VIBER Vibrators furnished upon request.

VIBER COMPANY EST. 1928
COORDINATORS OF INTERNAL CONCRETE VIBRATION
728 S. Flower, Burbank, Calif.

Tracing cloth that defies time



● The renown of Imperial as the finest in Tracing Cloth goes back well over half a century. Draftsmen all over the world prefer it for the uniformity of its high transparency and ink-taking surface and the superb quality of its cloth foundation.

Imperial takes erasures readily, without damage. It gives sharp contrasting prints of even the finest lines. Drawings made on Imperial over fifty years ago are still as good as ever, neither brittle nor opaque.

If you like a duller surface, for clear, hard pencil lines, try Imperial Pencil Tracing Cloth. It is good for ink as well.

IMPERIAL TRACING CLOTH

SOLD BY LEADING STATIONERY AND DRAWING MATERIAL DEALERS EVERYWHERE

Literature Available (Cont.)

WELDING AND CUTTING EQUIPMENT—A comprehensive publication issued by the Victor Equipment Company, San Francisco, Calif., describes and pictures the Victor Industrial Units WC-1, 2 and 3, and gives their operating range for welding and cutting. Included in the bulletin are: a concise description of the 300 Series Welding torch; general cutting units for hand-cutting operations; hand-cutting torches and head and tube assemblies; and Victor safety regulators.

PRE-ENGINEERED STOCK TEXROPE DRIVES—A new 144-page, indexed catalog for "pre-engineered" stock Texrope drives has been announced by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. The catalog is said to represent one of the most outstanding compilations of engineering data ever assembled. Nearly two-thirds of the book is devoted exclusively to pre-engineered stock Texrope drives for all applications from one to 150 hp. More than 22,000 stock drives are listed in this section.

JEFFREY GARBAGE GRINDERS—The Jeffrey Manufacturing Company of Columbus, Ohio, presents a bulletin on garbage grinders for dual disposal plants. Included in the bulletin are: recommendations for adding garbage to the sewage; methods of feeding series A and B grinders manufactured by the company; diagrams illustrating the grinders, and charts giving sizes, capacities, water requirements, power, speeds and weights.

INSTRUCTION FOR SEWER AND DRAIN INSPECTION—Clay Sewer Pipe Association, Inc., Columbus, Ohio, offers a bulletin giving "tips" on good construction for sewer pipe inspectors. The set of specifications has been drawn up by Myron T. Jones, a prominent consulting engineer of Columbus, Ohio. To make the instructions easy to use, they have been set up in blocks that can be cut out and pasted in an inspector's notebook. Each step of the inspection and each measurement, check or recording to be made is explained briefly but clearly.

HIGH INTENSITY RUNWAY LIGHTING—The American Gas Accumulator Company, Elizabeth, N.J., presents a pamphlet on "High Intensity Runway Lighting." This type of AGA Runway Lighting is being distributed by the General Electric Company, Schenectady, N.Y. Bulletin GEA 4931 contains the following: a complete description of the bi-directional light and its use; an evaluation of its performance; and an explanation concerning maintenance of the equipment, and cost and methods of installation. Ample illustrations and charts are included.

WRITING MATERIALS CATALOG—Eberhard Faber Pencil Co., Brooklyn, N.Y., presents a new catalog covering writing equipment manufactured by them. Of particular interest to engineers are the Microtomic, Van Dyke pencil, the draftsman's or artist's lead holder and leads and the Weatherproof Van Dyke colored pencils.

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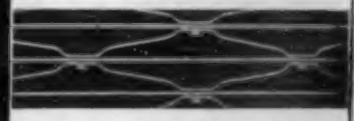
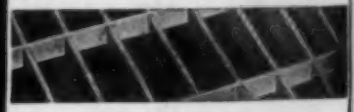
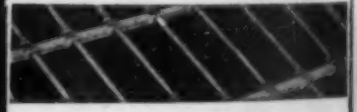


Riveted
Walkways — Stair Steps — Platforms
Trucking Aisles — Trench Covers



Press-Locked
Industrial Plants — Oil Refineries
Chemical Plants — Power Houses
Naval and Merchant Ships
Locomotive, Passenger and Freight Cars



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LONG ISLAND CITY 1, NEW YORK
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IMAGINATION AND "CATERPILLAR" POWER DO THE JOB IN RECORD TIME

A "Caterpillar" Diesel D8 with Hyster arch makes an ideal tool for rail removal, lifting one 62-foot section at a time.

Loading trucks with broken concrete, a "Caterpillar" Diesel D7 and Traxcavator work fast without disturbing traffic.

When the firm of Charles L. Harney took on the contract for removing and replacing streetcar rails on San Francisco's famous Market Street, the time limit set was 300 days. By the ingenious use of equipment never before tried on city streets, the job was completed 187 days ahead of schedule!

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"Our Market Street job has been 100% 'Caterpillar' powered, and all machines have operated 100% of the working time. Not one minute has 'Caterpillar' Diesel power let us down on this tight-scheduled job."

The line-up of equipment that handled the unusual contract so efficiently included a "Caterpillar" Diesel D13000 Engine, powering the compressor used on air drills and tampers; a "Caterpillar" Diesel D8 Tractor with Hyster logging arch that tore up the old rails; and a "Caterpillar" Diesel D7 Tractor with Traxcavator, for loading broken pavement into trucks.

Versatile and dependable, backed by dealer service that has won wide fame as the finest in the industry, "Caterpillar" Diesels are built to tackle the toughest jobs and return a profit to their owners.

CATERPILLAR TRACTOR CO., PEORIA, ILL.

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"That new Rex Tilter sure is a money-maker!"

You'll mix more yards per day . . . concrete or mortar . . . make more profit per job with a new Rex Tilting Mixer. It's the greatest money-maker you've ever seen.

Note these time-saving, job-speeding features. Perfect balance with low center of gravity and 62-inch wheel spread for fast, safe towing. Easy rolling pneumatic-tired wheels mounted with Timken bearings plus accurate balance make it easy for one man to spot the mixer. Four-point suspension assures stability while mixing . . . no "teetering" or shifting. Two-position loading . . . you can bring the barrow straight to the drum, head-on or sideways without interference. Fast, thorough mixing action and convenient controls. Long-lasting, all-welded, pressed steel drum bowl. Dependable, economical power plant. Complete lubrication from the outside.

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